AN EVALUATION MODEL FOR DETERMINING QUALITY IN ACADEMIC WEBSITES

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DECLARATION

This thesis is my original work and has never been presented for a degree in any other University.

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This thesis has been submitted for examination with our approval as the University Supervisors.

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DEDICATION

To Mum

Thanks for your unending love, encouragement and ensuring I got basic education

To my late Auntie Magdalene

Thank you for holding me up when it seemed like I would fall.

To my Brother, Sisters, Nephews and Nieces

Thanks for your continued support

I owe gratitude to God.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

HTTP -Hypertext Transfer Protocol

ICT – Information and Communication Technology

IT – Information Technology

ISO – International Organization for Standardization

SPSS - Statistical Package for Social Sciences

WBA- Web Based Applications

WBIS – Web Based Information Systems

WebApp – Web application

Web-QEM-Web Quality Evaluation Method

WWW- World Wide Web

WQM – Web Quality Model

4ICU – 4 International Colleges and University

SERVQUAL- Service Quality Model

QEMs- Quality evaluation methods

GA- Google Analytics

ABSTRACT

Academic websites are becoming popular for sharing information and for communication. Every passing day the number of institutions publishing their web sites is increasing. Every institution wants their web site to be of good quality. However institutions do not realize maximum user satisfaction due to issues of poor quality. Some quality metrics may affect indirectly on the popularity through their effect on the performance or the usability of websites. So it is necessary to evaluate a websites' quality so that it can satisfy the users. Quality can only be improved through a well-established quality evaluation model yet the number of web quality models that can be used right away to evaluate quality in academic websites are limited. Therefore the degree of quality of service delivered and user satisfaction is a major concern for any learning institution. The goal of this study was to propose a reliable weight based model for measuring quality in academic websites. For this purpose, a broad study of the literature on prevailing quality evaluation models, essential website success factors and criteria was made to identify necessary quality factors and sub factors that are desirable to academic websites. A Survey involving Web masters and developers was carried out to find out methods they currently use in assessing quality in academic websites. Purposive, stratified and simple random sampling techniques were used to acquire the study sample. Descriptive and inferential statistics were generated. The model developed in this study uses 7 high level quality characteristics branching into 26 sub characteristics with attached weights. The quality of an academic website was determined using a Quality index (QI). From the study it was found that QI 0.70 translate to excellent quality while for QI 0.40 and QI< 0.70 translate to Average Quality and QI 0.40 would translate to Poor Quality. The proposed model developed was then validated using five operative academic websites. From the validation it was observed that the proposed model offered a better criterion in evaluating academic websites as compared to Tsigereda Model which was used as a base model in this study. A tool was then designed to ease the evaluation process. The proposed model the researcher came up with in this study will suit both developers, web masters, institution administrators and extends the same to the users of an academic website

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Websites are becoming key components of an organization's survival in the globalized competition. The website represents an organization as a whole, communicating its culture, values, and vision to the rest of the world. It acts as a delivery mechanism for services that facilitate various tasks a stakeholder needs to perform. The website also serves as a platform through which an organization interacts with its stakeholders (Chingang &Lukong 2010).

The growth of internet, intranet and the World Wide Web has had significant impact in all sectors. The internet has become a very important strategic weapon in today's competitive business environment (Vida & Jonas 2011). Complex distributed application keep emerging in the web environment due to its popularity and nature of information represented in the web. For any organization, the website gives access to a large audience and improves operational efficiency (Ahmet &Aykut, 2012).

Website applications development has experienced tremendous changes and growth brought about by new services and devices. It is evident that websites are emerging as a key component of an organization's survival in our ever globalized and competitive world .While good quality internet service reduces the cost of services and absorbs more customers (Babak et al. 2012), and the dependency on web technology increases, there is need to assess the factors associated with website success increases as well (Layla & Emad 2008).

Besides the rapid growth of use of the internet and its connectivity, Manyika and Roxburgh (2011) indicate that the implications of the web-based applications are being felt in many other areas of organization which includes in the educational institutions setting. The consumers experience on a website is increasingly becoming an important topic both in academic and for organizations using websites to market their products and services (Nagpal 2013).The evaluation of the quality of websites

based on users or customer satisfaction is fundamental to obtaining and maintaining success over the internet. (Ueliton, 2011).

Website application quality is a complex, multidimensional attribute involving, correctness, reliability, usability, accessibility, security, performance, and conformance to standards. The dynamic nature of the current website environment and of the Internet in general, means that applications evolve very rapidly, as does the environment in which they run (Shirlee-ann & Janice 2005). Some methods provide direct support for the evolution of web applications or provide support for tracing design decisions at various levels, easing the maintenance problem.

However, the growing importance a website currently plays in such diverse application domains as business, education; government, industry, and entertainment have heightened concerns about the quality and quality of delivered web-based applications. It is necessary to have not only robust development methods to improve the building process but also consistent ways to measure and evaluate intermediate and final products as well. (Olsina , 2011).

Even though the design guidelines have been widely adopted and used in improving the design and development of websites, quality models and standards are not largely used. These quality models neither have particular properties of websites focused on particular domains nor do they consider different users point of view (Mebrate, 2010).

The popularity of educational websites is increasing day by day as it provides the student and other users an information platform where they can access the information and perform other various education related activities. A website offers a means by which web based applications can be accessed. In educational institutions, web based applications would include, the library system, e-learning system, student management information system and registration systems. A website gives an organization an audience beyond the walls and traditional users of their institutions. The university website is a way of shaping its images as well as a channel of communicating with various stakeholders such as students, faculty, administrative staff and visitors thus making it cost efficient and timely (Ahmet and Aykut, 2012).

Universities need to do everything within their power to keep positive images with their various constituents, and one way to do this is by making use of the opportunities website presents.This rapid growth of website applications increases the need to evaluate the existing websites.

In Kenya, more and more schools, colleges and universities are aware of the importance of having a website or an online presence. By this, the educational institutions not only serve the potential students, but also the teachers and staff, former alumni, parents, current students and prospective students as well. The function of the websites is not only to offer information's about their courses and their curriculum, but about current campus activities as well as outreach programs, scholarships and student support-services. The consumers of such services would include the students, their parents, financial supporters, donors, employers who in one way or another are influenced by the universities activities (Lidia et al., 2012)

Today many educational institutions understand the magnitude of having an online presence and hence designing websites for educational institution has become a highly specialized field. Designing an educational website involves creating a website that is not only functional but is eye-catching, informational and dynamic as well.

Nyambega (2010), evaluated some institutions' websites in Kenya and the results in his report indicated that most websites had events which were not frequently updated. The assessment indicated that most of the university websites have a series of grammatical mistakes. The evaluation further indicated that the news update was not frequently done. Other websites had some events which were still on the website, yet they had already taken place.

Nyambega (2010) goes on to mention that if one happens to be looking for a piece of information on most university websites in Kenya, it could take long hours on end of waiting only to be answered with a "Server-not-found" message. On the use of shape and user friendly fonts, some of the universities use horrific shapes and fonts, which may be termed as a mockery of creativity. On other websites, the fonts are too small for comfortable reading. As much as universities are supposed to generate content, not all of it is to be posted online. The University of Nairobi and Kenyatta University were noted to have overwhelming information on-line.

Since the year 2004, Webometrics has been used to rank world universities based on the volume of the web content, visibility and the impact of these web publications as per the number of site citations received. According to Webometrics (2014) in the evaluation of world universities reported that the University of Nairobi was ranked 9th in Africa and 1167 among world universities. A report by the 4icu.org University Web ranking (2015) ranked the University of Nairobi at 19th place, Moi University at 52nd place, Kenyatta University 65th place JKUAT at 97th position respectively in Africa. In Kenya the ranking results indicate that University of Nairobi takes the 1st position, Moi University at 2nd, JKUAT 5th and University of Eldoret 27th place. This indicates that the Kenyan education institutions websites still need some work done on them.

It is evident from literature that the quality of an education institutional website has a direct and positive impact on user satisfaction and user satisfaction has a direct and positive impact on use or reuse of software (Bai et al., 2008). However, due to the peculiarities and complexities of website applications, their quality assessment should be adaptable to the new environment and the new testing approaches that are needed (Nagpal et al, 2013).The basis of a sound educational website should be thequality of the website as a package.

The quality of any websites is strongly tied to its ultimate success. The quality of a website is an important issue which could determine the ability of the businesses to reap the benefits of being only. Websites could be associated with various problems such as incorrect navigation, broken links, reliability, out of web content. Better design and quality are most often achieved through the process of continuous assessment and evaluation of the web-based applications and subsequently making improvements based on those evaluations (Khan et al., 2010). All these problems stated can be overcome by a quality evaluation model for academic websites

1.2 Problem Statement

Although there are several quality models such as WebQEM, SERVEQUAL, WQM etc. that exist in literature; most of them are used to evaluate the quality of websites in particular domains such as museums, hotels and businesses. A model that can be

used to evaluate the quality of an academic website right away are limited. Preliminary investigations indicates that the web master who is in charge of academic websites makes changes on the website depending on his opinion and occasionally based on feedback from concerned users. The institutions do not have a criterion in place which the web master can use to make the website more effective and efficient. The information policy available is not clear on the criterion of assessing the quality of the website. The webmaster could be biased in making changes on some areas that he deems important in order to satisfy the needs of the users, institutions need to set up websites that provide quality information and services. By assessing the quality of a website the service providers are able to determine whether the website is meeting its intended purpose for the intended users. There are several website quality models currently available, even though most of them only provide broad website quality factors and only few are designed for the purpose of evaluating websites in particular domains like museums tourism, hotels, government and commerce or business. The general website quality evaluation models do not consider the requirements or needs of specific users of the website under evaluation, except listing broad quality factors and sub factors. An institutions website is a gateway to its information, products, and services and as such it should reflect the needs of the clients it serves. Nevertheless, there is need to come up with a quality evaluation model that aids in the assessment of the website quality from different user group perspectives. This proposed model will be used to assess institutional websites' quality and make recommendations to the technical personnel on the features that need to be improved on the website.

1.3 Proposed Solution

To overcome the above stated problem, this research work proposed to develop an academic website quality evaluation model by looking at the factors of website quality models that are desirable to academic institutions and identified how much this factors are desired hence attached weights bearing on their desires..

1.4 Scope of the study

A research was done on the areas of web evaluation models. Data was collected on various quality factors and analyzed to establish tables,

frequencies, percentages, means and standard deviations. And finally a design of a system was developed for use in evaluating institutional websites.

1.5   Objectives

The general objective of this thesis work is to design a metrics based quality evaluation model for academic websites. The web masters and web developers were considered for designing the evaluation model. The new evaluation model designed was validated using three operative academic websites.

The specific objectives of this research were;

1. To identify the factors of website quality frameworks that are desirable to academic institutions.
2. To identify how much this factors are desired hence attach weights bearing on their desires
3. To design a quality evaluation model for academic websites based on the desired weights of each factor.
4. To develop a system tool for use in testing quality in academic websites
5. To assess the effectiveness of the proposed academic website quality evaluation model.

1.6 RESEARCH QUESTIONS

The study was guided by the following questions:

1. Which website design quality factors are important for evaluating quality of educational websites?
2. What are the characteristics of existing software and website quality models?
3. What are some of the improvements that can be made on existing web quality models to make them better?
4. Does the developed model provide better quality for educational websites?

1.7 Limitations

This thesis is limited on designing a quality model for institutional websites quality, and therefore the centre was on website quality characteristics that reflect the

requirements of academic web Masters, academic Web developers and academic Web Users.

CHAPTER TWO

LITERATURE REVIEW

2.1. INTRODUCTION

This chapter discusses relevant literature to this study. It presents the overview of various models that have been used, the importance of quality on any given website and the various key factors that have been considered important to any website. This section plays an important role in the identification of gaps between the existing literature and the current study which needs to be filled out by this study.

2.2. Website quality

In a global and increasingly competitive market, quality is a critical success factor for all aspects of economical and organizational success. This is particularly important in any system or information systems (IS). Developing and selecting high quality software applications is fundamental. Bygren et al., (2013) asserts that the quality of software means conformance to the requirements of the software product's users and other stakeholders. The more closely a software product conforms to these requirements, the higher its quality. It is important that the software applications can be evaluated for every relevant quality characteristic using validated evaluation criteria. End- users have become savvier to their technological needs over the years and view technology as a basic utility. When technology is made available, it must be efficient, fast and user friendly with excellent customer services (Komiyama, 2011).Quality has been defined from different perspectives and orientations. According to Angela and Christopher (2009), quality is distinct according to the person making the definition, the measures applied and the context within which it is considered. They cite various definitions of quality as "excellence" (Peters and waterman, 1995) "value" (Feigenbaum, 1995), "fitness for use" (Juran & Gryana, 1988), "conformance to requirement" (Crosby, 1979) and meeting and/or exceeding users expectations" (Parasuraman et al., 1985). Users always demand for quality and their resultant behavior is replicated in terms of an attitude towards the products consumption i.e. number of visits to the site, which has led researchers and analysts to regard quality as a single most important factor for long term success and survival

(Vida & Jonas, 2011). Thus, quality aims at the needs of the user at present and in the future.

Quality is differentiable and stem from the expectations of users or consumers. Hence, it is necessary to identify and prioritize expectations for service and incorporate these expectations into a process for improving service quality (Chingang & Lukong, 2010). Implementing and evaluating service quality is a very complex process. There are two aspects that need to be taken into consideration when evaluating service quality, which are content and delivery of service. Customer satisfaction as transaction specific means that consumers get satisfied with a specific aspect of service while perceived service quality is a global judgment or attitude to a service.

Negi, (2009) clearly points out that overall service quality is significantly associated with and contributes to the overall satisfaction of customers. Customer satisfaction is based on the level of service quality delivered by the service providers which is determined by the consumer's cumulative experiences at all of the points of contact with company. This shows that there is some link between service quality and customer satisfaction which highlights that importance of customer satisfaction when defining of quality (Wicks & Roethlein, 2009). The same goes for an institutional website where users of the website are in the best position to evaluate the quality of delivery and the relevance of the services offered by the website.

The (ISO,1994) standard, defines quality from three views which include, users´ view, developers´ view, and managers´ view. In the academic domain there are three main general audiences regarding the user (visitor) view. This includes current and prospective students (and visitors like parents), academic personnel such as researchers and professors, and research sponsors. According to Babak et al., (2012) the website user would be mainly concerned in using the site such as, its performance, its searching and browsing functions, its specific user-oriented content and functionality, its reliability, its feedback and aesthetic features, and ultimately, are interested in its quality of use. These can be summed up into the research parameters used in the study as; usability, functionality, reliability, availability, security and efficiency. It is important therefore to evaluate the level of accomplishment of these characteristics and attributes which gives room for

researchers to be able to analyze and draw conclusions on the state-of-the-art of academic websites quality, from the current students, staff and faculty point of view.

2.3 Academic websites quality general perspective

2.3.1 Quality in terms of Service delivery

Chingang and Lukong (2010) defined service quality generally as the overall assessment of a service by the customers or the extent to which a service meets customer's needs or expectations. A service is a means of delivering value to customers, by facilitating outcomes customers want to achieve without the ownership of specific costs and risks. Service has been described to have four unique characteristics which are intangibility, inseparability, heterogeneity and perish-ability which make services different from physical products (Parasuraman, 2005). These characteristics are determinants that influence service quality as perceived by a consumer. Thus, a service must be well defined by the provider in terms of its characteristics in order to understand how service quality is perceived by consumers. Services are said to be intangible thus they can't be seen, tasted, felt, heard or smelled before they are purchased. The advance in technology and increased use of internet has great impact on services delivery. The interaction between consumer and service provider is very important when measuring service quality because through that interaction, the service provider could easily understand the consumer better and identify what he/she exactly wants (Chingang & Lukong, 2010).

Myunghee (2009) asserts that the internet has made it possible for service providers to show more additional services like frequent updating of information, easy navigation, accurate information and speedy response to customer needs. It has also made services more easily customized making the customers more active. However, delivery of service on a website is important in gratifying the preferences, perceptions and expectations of the customers.

It is important therefore to understand the users essential needs and hence be able to measure their satisfaction. Myunghee(2009) further indicates that the basic customer delivery services consists of inderstanding what the users need which can be done through frequent assessment and evaluations of user satisfaction. The users play a

very important role in service improvement hence service improvement is a commitment of ongoing listening to users and allowing them to input in service improvement process. Service quality is an ingredient of service delivery and so it improves service delivery.

According to Chingang and Lukong (2010), it is very important to measure service quality because it allows for comparisons before and after changes, identifies quality related problems, and helps in developing clear standards for service delivery. Literature search indicates that providing good service quality to customers retains them, attracts new ones, enhances corporate image, positive word-of-mouth recommendation and above all guarantees survival and profitability, Negi, (2009); Ladhari, (2009).

2.3.2 Service quality and web service quality

The website interfaces the services with the users or clients and its impact is relevant in the manner in which the service is delivered to the users or customers. Service quality through a website is an essential strategy to success. To deliver superior service quality, top management with web presence must understand how users perceive and evaluate the services (Chingang & Lukong 2010).

Service quality is commonly noted as a critical prerequisite and determinant of competitiveness for establishing and sustaining satisfying relationships with customers or clients. Service quality is an important indicator of customer satisfaction (Ueliton da Costa et al., 2011). If the management of an organization pays attention to service quality, it can lead the organization gaining a lasting competitive advantage.

Bai et al., (2008) defines web service quality as the extent to which a service meets users/consumer's needs and expectations. Service quality has also been defined as the difference between consumer expectations of service and perceived service (Parasuraman, 1985). Consumer dissatisfaction will occur if the expectations are greater than performance, then perceived quality is less than satisfactory. The end-

user satisfaction is an important aspect in research which considers the significant factor of measuring the IS/IT success and use.

Ahmet and Ertan (2010) suggest that service quality can be defined as the difference between customer's expectation for service performance prior to the service encounter and their perception of the service received. Customer's expectation serves as a foundation for evaluating service quality because, quality is high when performance exceeds expectation and quality is low when performance does not meet their expectation.Literature research cites Delone and McClean's (2003) with an updated IS success model. The model is concerned with quality and service quality which were uploaded into it. Delone and McClean (2003) identified information quality and system quality as antecedents of customer or end-user satisfaction.

Quality has been defined from different perspectives and orientations. According to Angela & Christopher (2009), quality is distinct according to the person making the definition, the measures applied and the context within which it is considered. They cite various definitions of quality as "excellence" (Peters and waterman, 1995) "value" (Feigenbaum, 1995), "fitness for use" (Juran and Gryana, 1988), "conformance to requirement" (Crosby, 1979) and meeting and/or exceeding users expectations" (Parasuraman et al., 1985). Users always demand for quality and their resultant behavior is replicated in terms of an attitude towards the products consumption i.e. number of visits to the site, which has led researchers and analysts to regard quality as a single most important factor for long term success and survival (Vida & Jonas, 2011). Thus, quality aims at the needs of the user at present and in the future.

Quality is differentiable and stem from the expectations of users or consumers. Hence, it is necessary to identify and prioritize expectations for service and incorporate these expectations into a process for improving service quality (Chingang and Lukong, 2010). Implementing and evaluating service quality is a very complex process. There are two aspects that need to be taken into consideration when evaluating service quality, which are content and delivery of service. Customer satisfaction as transaction specific means that consumers get satisfied with a specific

aspect of service while perceived service quality is a global judgment or attitude to a service.

Negi, (2009) clearly points out that overall service quality is significantly associated with and contributes to the overall satisfaction of customers. Customer satisfaction is based on the level of service quality delivered by the service providers which is determined by the consumer's cumulative experiences at all of the points of contact with company. This shows that there is some link between service quality and customer satisfaction which highlights that importance of customer satisfaction when defining of quality (Wicks and Roethlein, 2009). The same goes for an institutional website where users of the website are in the best position to evaluate the quality of delivery and the relevance of the services offered by the website.

According to Khan et al., (2010) web application meets specific user needs. In turn, by measuring and evaluating external quality, a software product's internal quality can be validated. Similarly, taking into account suitable software/web application attributes for internal quality is a prerequisite to achieve the required external behavior, and to consider suitable software attributes to external behavior is a prerequisite to achieve quality in use.

The (ISO,1994) standard, defines quality from three views which include, users´ view, developers´ view, and managers´ view. In the academic domain there are three main general audiences regarding the user (visitor) view. This includes current and prospective students (and visitors like parents), academic personnel such as researchers and professors, and research sponsors. According to Babak et al., (2012) the website user would be mainly concerned in using the site such as, its performance, its searching and browsing functions, its specific user-oriented content and functionality, its reliability, its feedback and aesthetic features, and ultimately, are interested in its quality of use. These can be summed up into the research parameters used in the study as; usability, functionality, reliability, availability, security and efficiency. It is important therefore to evaluate the level of accomplishment of these characteristics and attributes which gives room for researchers to be able to analyze and draw conclusions on the state-of-the-art of academic websites quality, from the current students, staff and faculty point of view.

Most websites today are diverse and due to this diversity of websites it is not practical to come up with a fixed model that is applicable to all website applications. According to Khan et al (2010) the success of a web-based system largely depends on the end-users' satisfaction. This satisfaction is grossly based on the operational quality attributes of the website. According to Mebrate (2010) web designers usually provide attention to that quality attributes which indicate certain aspects of quality from a designer's point of view but focusing on user-centric operational quality properties is more difficult and challenging. Mebrate (2010) argues that different users define quality for the same web-based product differently based on their various needs. It is difficult therefore to come up with a fixed model which can be able to address the quality requirements of website applications, since the requirements vary from one education site to another.

2.4. Academic website success key Quality factors

Website quality is determined by several factors. There is no one attribute that defines the success of a website. Mebrate (2010) asserts that the success of a website is in the long run based on the characteristics and tasks of the website components working together to create a website that can interact with users and provide user contentment. Several research works on website success has been done. Each highlighting different factors necessary to build a successful website. This section outlines the several key quality factors that were found to be more desirable to academic websites.

2.4.1. Website Usability

Website usability is concerned with how easy and intuitive it is for individuals to learn to use and interact with a website in order to quickly and easily accomplish their tasks (Adrian et al., 2009).It can also be described as the measure of the quality of a Website's presence, as perceived by users (Layla & Emad 2008).The ISO, (1994) standards define usability as the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use. The definitions of usability vary but all of them virtually include user's satisfaction. Web applications are

Increasing in its importance in various domains; thereby, the need for ensuring usability of the web applications (Adrian et al., 2009).

A good quality website is important for a number of reasons (Myunghee 2009), competitiveness being the major reason. The website needs to be appealing so as to ensure that people actually stay on it until the transaction is completed (Gour and Theingi 2009). Ueliten (2011) states that users of a website often cannot wait to complete their transactions on websites that take too long to respond to their requested services, those that do not facilitate the retrieval of information they are looking for, and those that do not present the information in a well-organized and relevant form. Chingang and Lukong (2010) suggest that website users range from experts to novices with dramatically different expectations and skills. Thus, it is important to understand the factors that increase website use by different users. Prior research suggests that high usability is associated with user-related positive outcomes, such as a reduction in the number of user errors and a more positive attitude toward the website (Eleanor et al 2007). In terms of interactivity, the website is the interface through which employees and user interact with the organization. The website users must be considered quality actors and critical ones indeed, since they can have a big impact on the global functioning of the site. In that sense, it is analogous to a brick and mortar store (Polillo2011). Usability therefore, is akin to a user-friendly and pleasant store environment and influences the website traffic. Teresa (2011), asserts that usability gives an impression of a strong customer orientation and services mindedness. Likewise, low usability portrays the opposite of these sentiments.

Ahmet and Aykut (2012) emphasize that website usability is conencerned with how easy and intuitive it is for individuals learn to use and interact with the website.It is a measure of the quality of a website as it is perceived by the users. Usability is greatly assiciated with a positive attitude toward the website (Nor & Tun 2008). In other web domains such as government sites or Museums, clients will just use a site with poor usability with a hope that the next release of the software or the next time they use the site the problem would be fixed. There is no second chance in academic website to getting usability right on a website application once users find it unacceptable, they move on to the next educational sites to get the required services. Tiphati et al.

(2009) asserted that usability characteristic as described by ISO 9126-1 model varies for websites of different domains and hence to evaluate usability of academic websites common set of metrics cannot be used.

2.4.2. Functionality

Functionality involves all the processes and applications that are behind the scene. According to Xin & Weiqi (2009), functionality entails how the public users interact with the site for services and the site's delivery. They further state that functionality refers to whether the website is functioning as it should be. Various statements have been used to measure a site's functionality which includes: Functionality includes all the technical and 'behind the scenes' processes and applications. Thus, functionality of the website entails the site's delivery of interactive services to all end users (Pressman 2010).This means that an academic website should do what it is needed to do, while usability relates to the question of how well users can use the function.

Most websites in different Domains are diverse and due to this diversity of websites it is not practical to come up with a fixed model that is applicable to all website functionality. According to Khan et al (2010) the success of a web-based system largely depends on the end-users' satisfaction. This satisfaction is grossly based on the functionality quality attributes of the website. According to Tsigereda (2010) web designers usually provide attention to the quality attributes which indicate certain aspects of quality from a designer's point of view but focusing on functionality operational quality properties is more difficult and challenging. Tsigereda (2010) argues that different users define quality for the same web-based product differently based on their various needs. It is difficult therefore to come up with a fixed model which can be able to address the quality requirements of website applications, since the requirements vary from one domain site to another and thus educational website should have its functionality attributes and sub characteristics

2.4.3. Efficiency

According to Teresa (2011) efficiency deals with the number of clicks that a user makes so as to complete a particular tasks as well as how much time a user takes or how many actions a user will perform to complete a task or reach a particular goal.

Information hosted on a website can be classified into static and dynamic content. Static content can be downloaded by the users containing the information and graphics designed for a page while dynamic content is created by programming languages that can accept the program arguments based on the users' requests made at the time when the user is consuming the services from the web. May & Yen (2007) define efficiency as the quality or property of being efficient, or the degree to which this quality is exercised. It can be computed as the ratio of the effective or useful output to the total input in any system or the ratio of the energy delivered by a machine to the energy supplied for its operation. Thus while considering efficiency and effectiveness of the web content to satisfy users, it is important to relate the performance measures of individual services to the measures of other services which contains static and dynamic contents. Efficiency is an important skill in avoiding time wasting and effort. It is important therefore to incorporate programming techniques that will make the implementation and maintenance of your website efficient (Soohyung et al., 2011).

According to Ahmet & Aykut (2012) asserts that the web site represents an organization, communicating an organization's culture, values, and vision. An institutional web site acts as a delivery mechanism for services that facilitate various tasks a stakeholder needs to perform. The site also serves as a platform through which an organization can interact with its stakeholders hence the information posted on the website should be timely and much updated to ensure efficiency. Xin & Weiqi (2009) affirms that the functionality of a website entails the site's delivery of interactive services to all end users, and it's important to note that this includes both the public as well as the immediate users within the institution. In order to satisfy the constantly changing demands of the website users and improve the features of the website, university web masters need to improve their sites efficiency based on a well stipulated sub factors that meet academic institutions criterions. Users of academic websites expect specific type of information in the website and a short period of time to access the information they want. These indicates that the users of academic websites are concerned more about whether or not they can find the information they are looking for or not and how long it would take them to find that particular information.

2.4.4. Reliability

Pressman (2010) cites software reliability as "the probability of failure free operations of a computer program in a specified environment for a specified time". This is termed as operational reliability. Operational reliability is an important criterion for any website application that gives services to users. The website must be reliable in the information that it provides to the public. An academic website should be designed in such a way that they do not allow an intentional operation failure, wrong information and transaction errors to occur. Kazimierz and Jerzy (2010), further stresses that reliability is one of the most important factors of web-based software and application. The reliability characteristic describes the capability of a software specification to maintain a specific level of performance under different conditions (Suryn, 2003). Based on the ever increasing applications on academic websites such as Online and distance learning as well as virtual classes, an academic website needs to be fully reliable.

2.4.5. Availability

There is no question that Website availability plays a major role in meeting the user's needs and so the website should ideally function as expected anytime, anywhere and for any customer or consumer. According to Pressman (2010), availability is the measure of the percentage of time that a website application is available for use. In reality, unscheduled downtime happens and often times it is due to factors beyond the organization's control. Disgruntled customers always have ripple effects on the use of the website in that the negative experience is shared with other consumers who in turn disseminate the same information to other consumers causing a long-term and at times irreparable damage to the organization (Teresa, 2011). The users should be able to access the website twenty four hours, seven days in a week and three sixty five days a year. According to Kazimierz and Jerzy (2010), argues that apart from the fact that the website must be available twenty four hours, seven days in a week and three sixty five days a year, the website must also be accessible to diverse browsers. When downtimes occur, the organization should take effective measures to ensure that downtime is minimized and this will help in maintaining

consistent and high rates of the website availability. Availability detects the behavior of the users since users will invariably go elsewhere if the website is not available. Mebrate (2010) asserts that academic domains have become common in using websites. Academic institutions use websites for wide variety of purposes which includes the distribution of information to the public, delivering online learning facilities to students, promotion of their educational and research programs and the like. Hence website availability is an important aspect in an academic website as compared to sites in other domains.

2.4.6. Security

Security is paramount when developing an academic website application. News articles daily report on security vulnerabilities and hacking attacks of online applications (Kuzma et al, 2010). This has caused consumers or users to be more concerned about misuse of their personal information and many are mistrustful of the security protection that organizations and institutions are employing. Organizations need to devote more resources to protect information on the website and that information security is a top concern in management, in its various forms, information is arguable the most important asset (Gerber and Solms 2008). Information helps people in their quest for further information and higher knowledge which is can lead to sound decision making and proper management of tasks and challenges. The rapid growth in web application deployment has created more complex, distributed IT infrastructures that are harder to secure. In the paste, organizations depended upon security measures at the perimeter of the network, such as firewalls, in order to protect IT infrastructures. However, more and more attacks are targeting security flaws in the design of web applications, such as injection flaws, traditional network security protection may not be sufficient to safeguard applications from such threats. In addition (Kuzma et. al., 2010) indicates that the developers of educational website applications need to understand the technical framework when designing and developing website applications, and they need to carefully review the security of their systems before implementing them n the servers.

A website often collects and stores a variety of sensitive, personal information about its customers in order to better serve them in their future visitations (Myunghee, 2009). Accordingly, privacy and security features have become sensitive and serious concerns to website customers. Privacy/Security involves transactional functions, which enable customers to feel the website is intuitive, simple, and user-friendly. Security is one of the key attributes of website service quality dimensions demonstrating trust for users to make transactions online. According to Kazimierz and Jerzy (2010), online services should be delivered and operated in a reliable and dependable manner to build trust and confidence from customers. They further observe that any breach of a company's website can cause significant revenue losses, large repair loss, legal consequences, and loss of credibility with customers or website users. However, despite the legal mandates and advice to fully test and develop secure systems; many educational institutions are not fully protecting their web users.

Young (2008b), reports that there are a myriad of computer security threats that universities face, but one of the top one includes malware, a large category which can include infected and insecure code. According to (Waters, 2009), the rise of web-based applications is the number one avenue of malicious hacker attacks. The root of most problems is due to software issues, such as poor coding practices in the applications, and that developers are developing insecure systems. Waters (2009) further says that the security vulnerability of educational websites is because of the use of media-based applications. This is increasing in growth especially in school or educational institutions where more content are accessed online.

Although application developers could easily become the scapegoat for website application systems, school administrators should realize that programmers may not have the

knowledge or training or create secure applications, and project managers may value speedy development and functionality over secure systems (Waters, 2009).Thus, educational institutions must have clear policies related to information protection. However, even with clear policies, if there is a lack of training of the staff or application developers, the institution may still find itself at risk to data theft and security holes within their systems. It is evident therefore, that web applications must

be able to handle customer data and other electronic information as securely as possible (Kazimierz and Jerzy 2010).

Security is presented as an attribute by Pressman (2010) in the Offutt model but in the ISO9126-1 it is presented as a sub characteristic of functionality. However in this study, literature studies indicate that security is an important factor in determining service quality in academic websites

2.4.7. Content Quality

Content is a critical part of the website. It is the reason as to why users visit the website. Websites are a combination of information, services or other functionalities. Service quality of the website is assessed in terms of the quality of the information, services and its functionalities. Websites provide services through the content or information provided on them. The importance of this characteristics has been noted by most authors with a motto "Content is king". Users in an academic website come looking for particular information. This is because the users have what they are looking for in mind before coming to the website and so they give less attention to other aspects such as the website design(Mebrate,2010) hence the inclusion of this aspect in assessing the academic website.

2.5. Different Methods of website quality evaluation

One of the main goal of academic website quality evaluation is to understand the extent to which a selected set of quality attributes fulfill a given set of quality stated requirements (Kumar, 2014)

In a wide sense, software artifacts are generally designed to meet some extent of quality and website artifacts are no exception. In designing website artifacts, there are many challenges that are frequently minimized. For instance when users log-in for the first time at a given homepage, they often figure out where to find a piece of information quickly. These attributes are aspects of quality, which are many attributes and characteristics that contribute to site quality that a designer must take into account when designing to ensure maximum utilization of such academic sites.

To be successful websites need to have good quality. Website quality can be measured from two perspectives; Programmers and End-users. The aspects of

website quality from programmers focus on the degree of maintainability, security, functionality etc. whilst end users are paying more attention to usability, efficiency, attractiveness etc. (Mathur, 2014).

Kumar (2014) emphasizes that the primary goal for web site quantitative evaluation is to understand the extent which a given collection of quality characteristics fulfills a selected set of needs regarding a specific user view. On the other hand, Kumar (2014) asserts that -web site domains like electronic commerce, museums, academic sites, etc., are becoming increasingly complex systems. Hence, an integral quantitative evaluation process regarding all relevant quality characteristics is also a complex issue. The evaluation complexity is caused by the large amount of intervening characteristics and attributes, and by the multifaceted logic relationships among attributes and characteristics. In addition, some relevant attributes to evaluate cannot objectively be measured so that only can be included after a subjective measurement made by expert evaluators.

The development of an academic Web site is a continuous process with an iterative life cycle of analysis, design, implementation, and testing (Murugesan, 2008). In the process of analyzing websites, Stolz et al. (2005) distinguished between three basic measurements: Web structure measurement (organization and navigability/links), Web content measurement, and Web usage measurement (as page view, sessions, frequency, unique users, and duration). Another view by Hasan (2009) categorized the assessment pattern into user, evaluator, and tool-based QEMs. But what we need really is a different focus on evaluation methods and a new categorization web system according to the purpose and platforms of evaluation based on different domains.

Reviewing previous studies on existing evaluation methods reveals that researchers in the field use the terms "Web evaluation methods" (WEMs) and "website evaluation methods" (WSEMs) interchangeably. That is, they do not differentiate between diverse platforms of assessment methods; neither do they consider the purpose of the evaluation. For example, some studies evaluate the Web as a whole phenomenon for the purpose of site ranking or the connectivity and visibility of sites, such as Dhyani et al. (2002) and Stolz et al. (2005). Others assess specific websites

against certain attributes aiming to discover the usability problems of the site, such as the studies of Calero et al. (2005), Dominic et al. (2010) and Treiblmaier et al. (2010).

Several studies shows that websites can be evaluated based on the following methods; user-based evaluation methods, programmer-based evaluation methods, automatic tools evaluation methods and using quality evaluation models.

2.5.1. User-based evaluation methods

User-based evaluation methods usually involve user's pre-defined tasks being taken into considerations with the purpose of identifying usability problems (Brinck et al., 2001). User-based approaches have been frequently used to evaluate the usability of e-commerce websites (Agarwal and Venkatesh, 2002; McKinney et al., 2002). For example, McKinney et al. (2002) developed constructs and corresponding measurement scales with users for measuring web customer satisfaction and Tilson et al. (1998) asked sixteen users to complete tasks on four e-ecommerce sites and report what they liked and disliked. Freeman and Hyland (2003) also used a similar technique to evaluate and compare the usability of e-commerce sites. Research outcomes proved the usefulness of user-based methods in identifying major design problems which prevented users from interacting with the sites successfully.

Website User-based Evaluation focuses on how well users can learn and use a site to achieve their goals. It also refers to how satisfied users are with that process. To gather this information, practitioners use a variety of methods that gather feedback from users about an existing site or plans related to a new site. This involves use of models and automated tools developed from such models.

The key to developing highly usable sites is employing user-centered design. The expression, "test early and often", is particularly appropriate when it comes to usability testing. As part of user quality evaluation none should test as early as possible in the process and the variety of methods available allow you to assist in the development of content, Information architecture, visual design, interaction design and general user satisfaction. (Usability.Gov, 2015)

User based evaluation methods majorly deals with the quality of a user's experience when interacting with websites applications on issues about effectiveness, efficiency and the overall satisfaction of the user.

It is important to realize that user based quality evaluation is not a single, one-dimensional property of a product, system, or user interface. Usability.Gov (2015) states a combination of factors including:

Intuitive design: a nearly effortless understanding of the architecture and navigation of the site

Ease of learning: how fast a user who has never seen the user interface before can accomplish basic tasks?

Efficiency of use: How fast an experienced user can accomplish tasks in the academic site?

Memorability: after visiting an academic site, a user should remember enough to use it effectively in future visits

Error frequency and severity: how often users make errors while using the website applications, how serious the errors are, and how users recover from the errors

Subjective satisfaction: If the user likes using the academic site.

2.5.2. Programmers-based quality evaluation methods

Evaluators or experts inspect the interface and assess website using interface guidelines, design standards, users' tasks, or their own knowledge, depending on the method, to find possible user problems (Lárusdóttir, 2009). The inspectors can be usability specialists or designers and engineers with special expertise (Matera et al., 2006). In this category, there are many inspection methods, such as cognitive walkthrough, guideline reviews, standard inspection, and heuristic evaluation (Hasan, 2009).

This method may also include use of software tools to identify website problems. Web analytics is an example of this approach and involves collecting, measuring,

monitoring, analyzing and reporting web usage data to understand visitors' experiences (Web Analytics Association). There are two common approaches to web analytics. These are server-based log file analysis and client-based page-tagging (JavaScript tagging). Analysis of server-based log files was the first approach used for web analytics. It involves the use of a server's log file to collect access and visit data.

Kaushik (2007) indicated that while the log file technique was used widely as a data source for web analytics, the disadvantages of using this approach, that is, the use of caching techniques, and the use of IP addresses to identify unique visitors were noticed by both web analytics vendors and customers. These challenges led to the emergence of page-tagging techniques as a new source for collecting data from websites. Page-tagging involves adding lines of script majorly JavaScript code to the pages of a website to gather statistics from them. Page tagging is typically more accurate than using web server log-files. Reasons for the improved accuracy of this method are that most page tags are based on cookies to determine the uniqueness of a visitor and not on the IP address, and this method is not influenced by caching techniques (Kaushik, 2007; Peterson, 2004).

An example of a web analytic tool that uses the page-tagging approach, and which has had a major effect on the web analytics' industry, is Google Analytics (GA). Peterson,(2006) states that web metrics give meaning to data collected by web analytics tools. He further categorized them into two categories, basic and advanced. Basic metrics are raw data which are usually expressed in raw numbers, that is, visits and page views. Advanced metrics are metrics which are expressed in ratios or percentages instead of raw numbers and are designed to simplify the presentation of web data, and to guide actions that optimize online business. Peterson (2006) gave an example of bounce rate metric, which represents the percentage of single page visits: i.e. visits where users left the site after visiting only one page

The use of basic metrics to measure the traffic of websites has been criticized for several reasons, one of which relates to their simplicity in addressing only some aspects of web measurement (Inan, 2006; Phippen et al., 2004). Most of the earlier

studies that used web analytics to evaluate and improve the design and functionality of websites used log-file based web analytics and employed basic metrics included in the reports generated by the web log analyzer (Jana et al. 2004; Ong et al., 2003; Peacock, 2003; Xue, 2004 and Yeadon, 2001).

Despite the literature outlined above, there has been little research evaluating the quality of academic websites employing user-based, evaluator-based and programmer-based evaluation methods together.

2.5.3. Automatic website evaluation tools

The first study of automatic tools was conducted by Ivory and Chevalier (2002), who concluded that more research was needed to validate the embedded guidelines and to make the tools usable. Thus Web professionals cannot rely on them alone to improve websites.

Brajnik (2004b) mentioned several kinds of Web-testing tools: accessibility tools such as Bobby, usability tools such as LIFT, performance tools such as TOPAZ, security tools such as WebCPO, and classifying website tools such as WebTango. He stated that the adoption of tools is still limited due to the absence of established methods for comparing them and also suggested that the effectiveness of automatic tools has to be itself evaluated (Brajnik, 2004).

There are many automated tools available as either Web-based services or desktop applications such as Cynthiasays (http://www.cynthiasays.com/) which is a product from HiSoftware that allows you to enter the URL to be analyzed in to the site and get a report on how it complies with Section 508 standards and/or the Web Content Accessibility Guidelines (WCAG) but do not give the general overall quality of a website.

2.5.4. Website evaluation using quality models

A model is built on a set of attributes around which to a frame and structure appraisal questions that might be asked in a piece of website in order to critically assess its quality. In each case, a set of quality indicators is listed and the features that will help to form a judgment. Horgan (2005) defines a Quality Framework as a framework

with the objective to describe, assess and/or predict quality. Khaddaj (2005) further defines Quality Framework as a framework to define, evaluate and improve quality. This usually includes a quality Meta framework as well as a methodology that describes how to instantiate the Meta framework and use the framework instances for defining, assessing, predicting and improving quality

Quality models have always been used as a basis of website quality evaluation, coding standards or guidelines (Tian, 2004). Quality models provide direct recommendations on approaches to evaluate websites' quality as well as approaches to improve website quality. A quality model is the basis of all quality measurements, that is, for measuring the activities, the all site, and the general website interface (Neil 2009). A model generally encompasses quality criteria for characterizing the quality attributes of a website product.

2.6. Aspects in Quality model development

For one to effectively assess the quality of a website, it is essential to craft a website quality evaluation method. A well-defined approach will provide a structure for the website quality evaluation model, website quality criteria and quality evaluation procedure. The results will be a group of scores which relate to a substantial range of "quality characteristics" features and the appropriate to the radical live-website quality requirements.

According to ISO/IEC 25000:2005, a quality model (QM) is a "defined as a set of characteristics, and of relationships between them, which provides a model for specifying quality requirements and evaluating quality." Each sub-characteristic may be further hierarchically decomposed. Quality characteristics and sub-characteristics at any level should be measurable, either directly or indirectly, through a set of associated measurable properties.

2.6.1. Defining Top-level quality characteristics

The initial aspect in model development is the development of top level quality characteristics (Ortega, 2003). Each quality top level characteristic can take a real value-the measurable and computable value. This value represents the outcome

quality, which can be interpreted as the degree of satisfaction required (Zhou, 2009). The top level characteristics are defined through in-depth document analysis, data analysis, use of conceptual framework as guide, effects of new technologies used in a website as well as guidance from experts (Zhou, 2009, Ortega, 2003).

It is necessary to effectively classify quality characteristics that are suitable to academic websites. Once these top quality level characteristics are carefully identified, they are then broken down into the lower levels sub characteristics that can be refined into a set of measurable indicators of academic websites' quality.

2.6.2 Defining lower-level quality sub characteristics

Quality sub characteristics are lower level quality criteria that break down its parent characteristics to more measurable criteria. Once the quality top level characteristics are defined, they are broken and refined into a set of measurable sub characteristics. The quality sub characteristics scoring formulae should be defined, with every relative indicator considered by means of weights.

Each quality top level characteristic has a list of sub characteristics which should add up to the overall quality weight of the overall top level characteristics. The definition of sub characteristics is less critical. Once the top level framework is stable and well understood, the lower levels can be tailored to specific contexts and improved over time, as experience in the use increases and web applications evolve (Polilo, 2007)

The sub characteristics should be tailored and defined to specifically academic sites. This is the case, for example, for functionality and content quality, which should be specialized to particular functions and content supported by academic websites. ISO 9126-1 standard explains that the set of sub characteristics associated with a characteristic should be selected to be typically representative concerns without being exhaustive, and should describe that attribute.

Polilo (2009) asserts that a website quality model should start from a very general top level characteristic mapped to several factors responsible for quality to specifity of a website. The model developed defines characteristics down to the second level sub characteristic, majorly tailored to academic sites.

2.7. Existing Website quality models

This section presents previous website quality evaluations models. Using these models, a suitable quality evaluation model for educational institutions' websites will be developed. Instead of building an assessment model from scratch, these criteria and techniques will be used as a base to develop a website Quality assessment model.

2.7.1. Web - QEM (Web Quality Evaluation Model)

This model has been used to objectively evaluate the website applications according to Adrian et al., (2010). This model has been used to assess how web applications help to meet quality requirements in new Web development projects and to evaluate requirements in operational phases. It helps discover absent attributes or poorly implemented requirements, such as interface-related designs, and implementation drawbacks or problems with navigation, accessibility, search mechanisms, content, reliability and performance, among others. The Web QEM evaluation is a tool that is evaluator- driven, done by the domain experts rather than the users. This method is more objective than subjective and it is quantitative and model centered (Khan et al., 2011).

The quality characteristics in this model are based on the ISO 9126-1 model and therefore its characteristics include Usability, reliability, efficiency and functionality. (Mendes 2006). The evaluation process in the model involves the following steps:-

- Selecting a website or sets of websites to compare or evaluate
- Specifying evaluation goals and intended user's view point
- Defining the quality characteristics and sub-characteristic attributes requirement tree
- Defining criterion function for each attribute, and applying attribute measurement
- Aggregating elementary preference to yield the global website quality preference
- Analyzing, assessing, and comparing partial and global outcomes
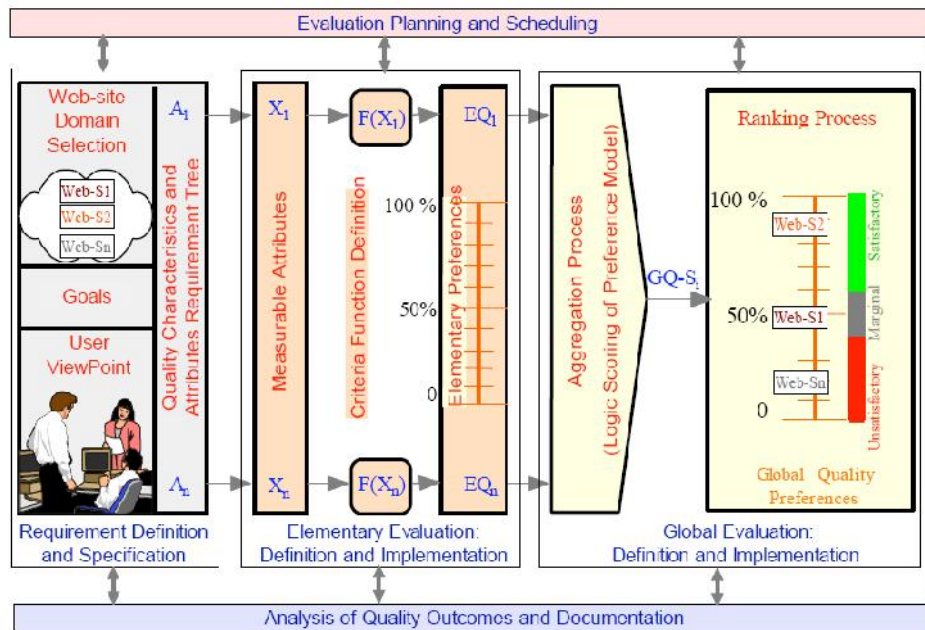
FIGURE2: 1 WEB-QEM MODEL (TSIGEREDA 2010)

According to Tsigereda (2010) the Web-QEM model is unique in that it gives a domain specific approach and a step-by-step procedure to accomplish the evaluation of the chosen website. Nevertheless using this model , the end users only participate at the earlier stages and the rest of the evaluation process done by experts , thus leaving more subjectivity to experts and thus do not represent the usability of the website as compared to the developed model which captures the quality of a website in terms of organizational, User and Technical Perspective. This method is more objective than subjective and it is quantitative and model centered (Khan et al, 2011). Furthermore the web-QEM model do not capture all factors of a modern day academic website which is now an enriched all round site ,full of web applications riddled with tough task of security, availability and rich contents not captured in the Web-QEM model but captured in the developed model.

2.7.2. Web Quality Model (WQM)

Vida & Jonas (2011) present the Web Quality Model (WQM), which was intended to evaluate a Web application according to three dimensions: Web features (content, presentation, and navigation); quality characteristics based on the ISO/IEC 9126- 1

(functionality, reliability, usability, efficiency, portability, and maintainability); and lifecycle processes (development, operation and maintenance) including organizational processes such as project management and reuse program management. Ramler et al. (2012) defined a WQM cube structure in which they considered three basic aspects when testing a web site. Following on from this idea, (Ruiz et al., 2013) proposed another "cube", composed of those aspects to be taken into account in the evaluation of web site quality: features, life-cycle processes and quality aspects, which can be considered orthogonal. The model was reviewed by basing the features dimension on aspects relevant to the web found in the literature (Calero et al., 2014).

Web features dimension in this cube dimension include the three "classic" web aspects: content, presentation and navigation (Baresi et al., 2013; Go´mez et al., 2011). Navigation is an important design element, allowing users to acquire most of the information they are seeking and making that information easier to find. Presentation and content are prime components in making the page easier to use (Palmer, 2012). In content, it includes not only data such as text, figures, images, video clips, and so on, but also programs and applications that provide functionalities like scripts, CGI programs, Java programs, and others. In this model Content deals with structure and representation issues. Because of the close intertwining of functions and data, the borders between them are not clearly drawn, and are considered to be the same. Navigation is concerned with the facilities for accessing information as well as moving around the web. Presentation is related to the way in which content and navigation are presented to the user.
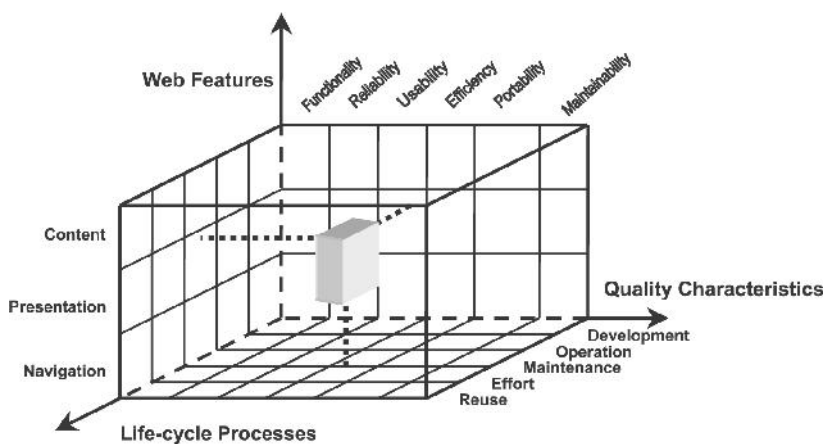
FIGURE2: 2 THE WEB QUALITY MODEL (RUIZ ET AL., 2013)

Although WQM model do not tend to be practical in usage, it is extremely useful in setting up the stage for discussion on whether development process should be involved in the evaluation process. Nevertheless in development in an academic site issues such as portability do not matter due to the structure of the www. One of the limitations of the WQM is that it does not have further sub characteristics for the factors and lack of a step by step evaluation criterion. Furthermore factors such as navigation and presentation are mainly sub-factors of usability which have been used to evaluate websites as independent factors in the WQM model.

2.7.3 MiLE Lugano model

This model proposed a technical inspection for evaluating application independent aspects. It suggests to use user-experience and scenario based testing for the application dependent aspects of a website (Micali, 2008). This model is a usability focused evaluation method based on the combination of inspection from expert evaluation and user empirical testing. The evaluation method in this model include: Content, services, navigation, cognitive features of the interface, aesthetic/graphical level and technology used.

This model just like WQM lacks a well outlined evaluation criterion. This model majorly focuses on the aspect of usability and ignores other important aspects of website quality evaluation such as efficiency, functionality, reliability among other factors and thus cannot be used right away to evaluate an academic website from all angles.

2.7.4. SERVQUAL model

The SERVQUAL model was used as the main concept to assess service quality and customer satisfaction (Chingang and Lukong, 2010). This means that customer satisfaction could be measured using the various service quality dimensions. SERVQUAL model is an empirically derived method that has been used by a services organization to improve service quality. The method involves the development of an understanding of the perceived service needs of target customers. These measured perceptions of service quality for the organization in question, are then compared against an organization that is "excellent". The resulting gap analysis

may then be used as a driver for service quality improvement. Chingang and Lukong (2010) further indicated that SERVQUAL originally had five service quality dimensions which included Tangibles, Reliability, Responsiveness, Assurance and Empathy. This model was later modified and adapted to cover ten dimensions of quality service: Tangibles, Reliability, Responsiveness, Competence, Courtesy, Credibility, Security, Access, Communication and Understanding the customer. This model takes into account the perceptions of customers and the relative importance of service attributes which are prioritized by the organization so as to improve the most critical service attributes.
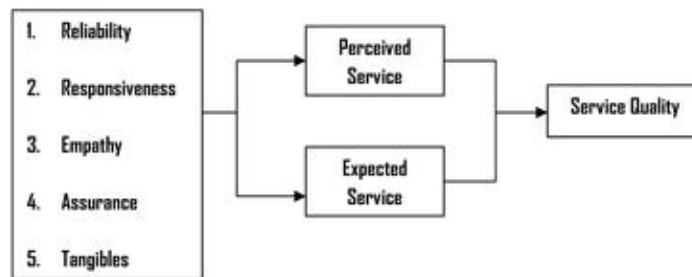
FIGURE2: 3SERVQUAL MODEL (CHINGANG AND LUKONG, 2010).

The model consists of five quality attributes—with no sub factors that influence them. Notably, the model does not include any weights for measuring the quality of a website but instead tries to compare an excellent website with another. This model takes into account the perceptions of customers and the relative importance of service attributes which are prioritized by the organization so as to improve the most critical service attributes but do not take care of other perspectives like Technical and security which have been captured in the new model.

The evaluation method generally involves the development of an understanding of the perceived service needs of target customers which can be ambiguous for an evaluator who is not an IT expert. The measuring of selected perceptions of service quality for the organization in question and comparing it against an organization that is "excellent" is not a straight forward activity as well.

2.7.5. ISO 9126-1 quality standard model

The ISO 9126-1 presents a quality model that describes six categories of software quality which are relevant during product development that include functionality,

reliability, usability, efficiency, maintainability and portability. The quality of software products can be described in terms of quality characteristics as defined in the ISO 9126-1 standard. Komiyama (2011) expounds on the ISO 9126-1 where quality is defined as "the totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs". However, the state of the art in software measurement is such that, in general, the direct measurement of these characteristics is not practical. However, it is possible to assess these characteristics based on the measurement of lower abstraction attributes of the product". Despite the ISO 9126-1 standard being initially developed to evaluate quality in software engineering, several researchers have cited that it is also widely used in the evaluation of websites. Here a website is treated same way as a software.

The ISO 9126-1 series of standards (ISO 9126, 2001, 2003) address software quality from product perspective through its four parts. Part one of this model was revised to specify a quality model that distinguishes three different approaches to software quality: internal quality, external quality, and quality in use. Internal quality is defined as the totality of a product that determine its ability to satisfy stated and implied needs when used under specified condition (Mendes, 2006) .

Internal quality is measured and evaluated by a set of document like specification requirement; architecture, design or piece of software code. This includes characteristics like testability, flexibility and fault tolerance. External quality includes characteristics like performance, reliability, usability and integrity. Quality in use refers to the extent to which a product used by specified users meet their requirements to achieve specified goals with effectiveness, productivity and satisfaction in specified context of use (Mendes, 2006)

In ISO 9126-1 quality in use indicates the effectiveness, productivity, safety and satisfaction of users in the actual context of usage rather than measuring the quality of the software (Cote, 1996). Moreover all the three approaches are inter-related. The ISO 9126-1 model therefore act as a starting point for conducting website evaluation, it can be adopted to include essential quality characteristics of academic website under study, so to speak.
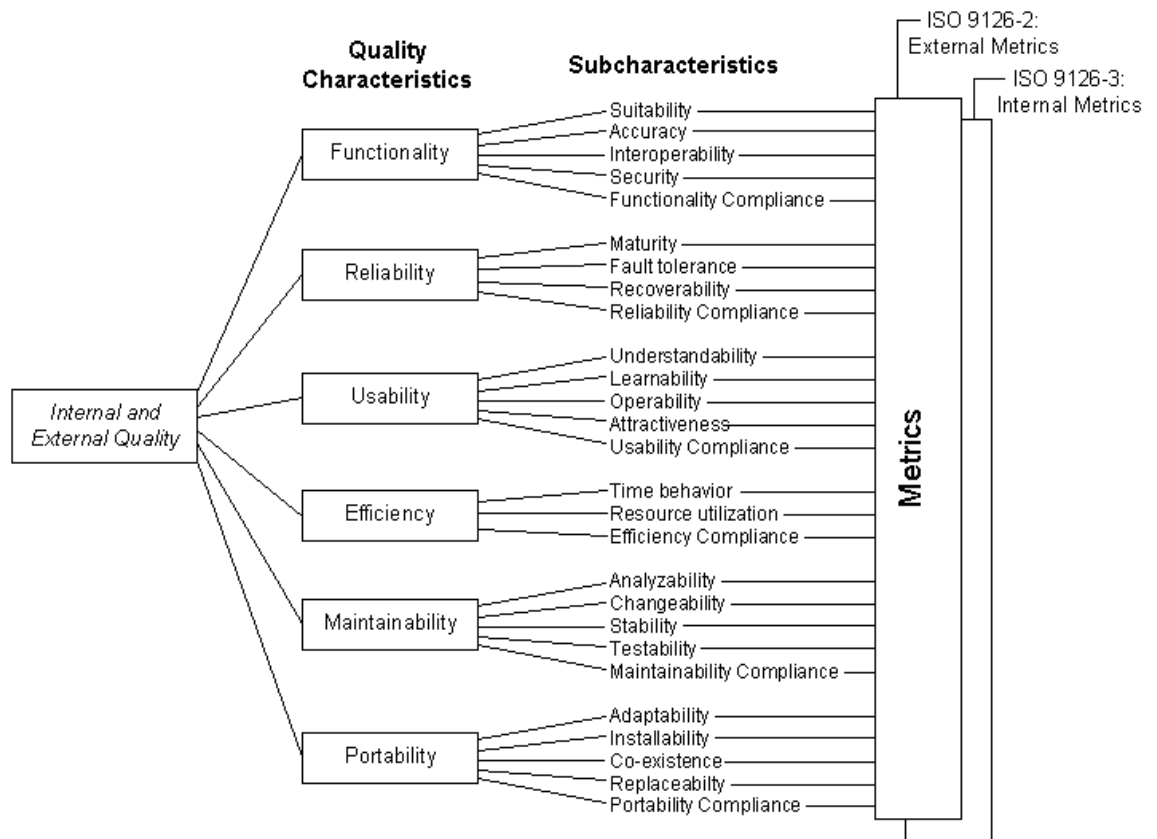
FIGURE2: 4 ISO 9126-1QUALITYSTANDARD (Mebrate, 2010)

Anusha (2014) states that a website evaluation method should evaluate a website's quality based on its domains such as e-commerce, education, entertainment, etc. He states that it is necessary to create a comprehensive website evaluation method that is applicable to the concerned domain. According to this quality model, a comprehensive website evaluation method is required to address common quality elements of the web application, since the elements vary for different kinds of websites.

One of the most important limitations of the ISO 9126 model according to Rachida (2012) is its generality; The model does not describe the business manager needs which are represented in the Return on Investment and Sustainability quality factors. The traceability of the software and the consistence of the data are not represented in the model. The model also does not include measurements methods (Rachida, 2016) In ISO 9126-1 quality in use indicates the effectiveness, productivity, safety and satisfaction of users in the actual context of usage rather than measuring the quality of the software (Cote, 1996). Moreover all the three approaches are inter-related. The

ISO 9126-1 model therefore act as a starting point for conducting website evaluation, and thus the researcher tried to include essential quality characteristics of ISO 9126-1 in the development of academic website model. In contrast, some characteristics like changeability cannot be easily determined using the model. The model also looks at the basic facts of a website and much detail like content and security is not put into consideration.

2.8. Tsigereda Model

Tsigereda (2010) designed a website quality evaluation model for academic sites from student's perspective. In his study he proposed a new and improved quality evaluation framework consisting of five high level quality factors (Content, Usability, Reliability, Efficiency and Functionality), hierarchically arranged into sub quality factors and criteria.

2.8.1 Weaknesses of Tsigereda Model

- The model only focuses on one group of academic websites that is from student's point of view thus the model fail to include other stakeholders in the evaluation task. It could have been much better if the model gathered for other evaluators such as web administrators, web developers and other concerned stakeholders of an academic website. This would ensure that the monitoring of quality can be done as early as during development.

- The model only consists of a list of hierarchical list of quality factors. After generating quality factors and sub factors, it would be interesting if the author developed a tool to ease evaluation.

- The base model does not factor in the different importance of factors in evaluating quality. The model does not assign weights. It only uses likert format questions to indicate whether a student agrees or disagrees. The real weight of the sub factors should be identified.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1.   Introduction

In this chapter, the methodology used is presented. The research design adopted, the target population, description of the sample and sampling techniques, instruments, and data collection instruments and data analysis procedures are discussed.

3.2.   Study Design

According to Burns and Groove (2005), quantitative research is conducted to describe, examine and determine relationships among the variables. This study adopted descriptive design which was the most suitable design because it is more accurate in getting information on different aspects on the website quality factors from web masters and developers. The design was used in gathering quantitative responses from the respondents in order to ascertain the extent to which some quality aspects of an academic website were relevant.

3.3.   Target Population

The study targeted Web Masters and Web developers of selected Kenyan universities and Technical Training institutes. The total population was approximated to 70 web developers and 67 webmasters. The web masters and web developers were chosen because of the following reasons:-

    a. **Website developers:** A web developer is a programmer who specializes in, or is specifically engaged in, the development of World Wide Web applications. They are in a better position to provide information about the analysis methods they employ when developing academic Websites, the quality models they employ, the problems they experience. They can also provide few references to challenges in development and projects which either collapsed or succeeded and critical factors which promoted success or failures. They are the major sources of information.

    b. **Web Masters**: Are persons responsible for maintaining one or many websites. The duties of the webmaster may include:

ensuring that the web servers, hardware and software are operating correctly, designing the website, generating and revising web pages. They will assist to provide primary information about the problems they have with the academic websites they administrate, how they present their needs and quality aspects they consider most important to the web developers.

Nevertheless the researcher did not collect data based on the user perspective due to being in agreement with the base model. The base model (Tsigereda Model) is based on quality model majorly used in evaluating an academic website from the user perspective.

3.4   Data Collection Methods

The researcher designed a questionnaire to be used to gather data for the study based on the research parameters. The questionnaires designed were used to solicit information on the sample population. The questionnaire allowed measuring of a set of requirements that contribute to the quality of a website given a set of predefined parameters.

The questionnaires were chosen because they collect a lot of information over a very short period of time, are cost effective and the data collected are easy to analyze. The data can also be quantified for analysis by a computer software package. The use of questionnaires also reduced the possibility of bias since they have uniform questions and that the researchers' own opinion does not influence the respondents to answer questions in a certain manner.

3.5 Sample and Sampling Techniques

Purposive, stratified and simple random sampling and random sampling techniques were used to pick a sample from each category and for the purpose of ensuring representativeness of the web developers and web masters. For this study, a sample size of 106 was involved in the study, which was distributed in percentage depending on the number of members in each group. The desired level of accuracy was set to a confidence level of 95% and an absolute precision (relative margin of error) of 5%.In determining the sample size, the researcher adopted the Slovin's formula as shown below.

$$n = \frac{N}{1 + Ne^2},$$

Where :   n = sample size to be studied

N = Total population

E = Margin of error (0.05)

Status of respondent

Status	Frequency	Percent
Web masters	52	49.5
Web developers	54	50.5
Total	106	100.0

3.6.   Data Collection Instruments

The researcher designed a questionnaire to gather the data for the study based on the research parameters obtained in objective number one. The questionnaires were designed to solicit information from the web masters and web developers. The Questionnaire had open and closed ended items. The proposed data collection instrument for this project was a design likert scale that allowed the researcher to assign numbers 1-5 to collect both qualitative and quantitative data about quality of websites from the sample population. Likert scale was chosen because of its straight forward nature, ease of analysis of data. An open ended questionnaire also accompanied the likert scale to allow for collection of qualitative data on the general feelings of the sample population about the quality factors of the websites in use today.

3.7.   Statistical Treatment of Data

Descriptive and inferential statistics was used to analyze the collected data. Descriptive statistics was employed to establish tables, frequencies, percentages, means and standard deviations in order to analyze data for research questions and

inferential statistics (ANOVA) was used to determine the developers assessments based on their status to respond to questions.

Descriptive statistics enabled the researcher to summarize and organize the data in an effective and meaningful manner. It provides tools for describing collections of statistical observations and reducing information to an understandable form. This includes:

a) Arithmetic mean: this describes the central tendency for a group. It is used in tests of mean differences between groups.

b) Percentages: used to show the differences of a part to the whole.

c) Standard deviation: this is a measure of the spread of responses and the range of answers. A small standard deviation shows considerable agreement; a large standard deviation shows less agreement. Inferential statistics will allow the researcher to make decision or inferences by interpreting data patterns.

3.8 Model Metric generation

A website quality metrics is defined by a measurement method and the measurement scale. In order to evaluate the number of measurable physical or abstract attributes for understanding and optimizing websites usage. In Websites Quality Metrics, Lilburn et al proposed a Quality Compliance Framework (QCF) consisting of components such as quality measurement, quality characteristic, quality sub-characteristic and measurable indicator. The QCF was used to generate the model weights based on the data collected from the Likert scale.

The following formulas show how the quality measurement is calculated for different components of QCF:

Quality measurement

Quality Measurement = Children QCF/ No. of children.

Characteristics and sub-characteristics of QCF score

Quality Characteristic Score = Children's QCF/ No. Of children

• **Attribute QCF score**

Quality indicator = (Earned Score/ Possible Score). Here "Children" refers to the quality characteristics, quality sub- characteristics, or quality indicators in the hierarchy.

3.9 Model tool design

Once data is collected on the adopted factors, each factor will be divided into measurable quality sub factor characteristics. The model validation control tool sample was developed based on this. The tool was designed through the use of case, activity diagrams and robust analysis design. The design of the model tool will help to represent the general functionality of the model. This will act as a control sample that will capture metrics automatically to test the quality aspects of the proposed model and compare the results with the existing models as well as proof of concept.

3.10 Model validation

In order to ascertain the effectiveness of the proposed model, a validation process was carried out using five operative academic sites. The chosen sites are typical and well known regionally as well as globally. The major aim of this validation process was to further understand and compare the current level of realization of a given set of requirements with regards to quality in academic websites and that the final tool developed after the research meets its intended goal.

To conduct the research the following academic websites were purposively selected:-

Name of institution	URL
Jomo Kenyatta University of Agriculture and Technology	Www. Jkuat.ac.ke
Moi University	www.mu.ac.ke
University of Eldoret (UOE)	www.uoeld.ac.ke

CHAPTER FOUR

DATA ANALYSIS, INTERPRETATION AND PRESENTATION

4.1.   Introduction

This chapter presents a discussion on the presentation, statistics analysis, and interpretation of data collected from the questionnaires. The findings are presented, analyzed, and interpreted. Inferences and meanings were drawn from the findings of the data analysis and compared with the presented literature. The discussions of the findings are presented in tabular form to facilitate easy reading, comprehension and understanding.

4.2.   Description of the Respondents'

This section gives a brief presentation of the demographic data of the respondents that were involved in the study.

Gender of respondents and their status

		Status of respondent		Total
		Web developers	Web Masters	
Gender of	Male	28	39	67
respondents	Female	26	13	39
Total		54	52	106

TABLE4: 1 DESCRIPTIVE STATISTICS ON GENDER OF RESPONDENTS
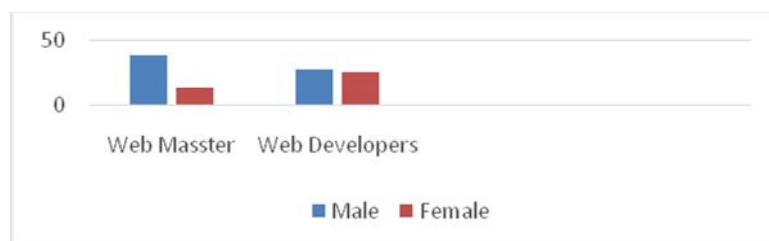
FIGURE 4: 1BAR GRAPH OF RESPONDENTS' GENDER

From the data presented in the Table 4.1 and Figure 4.1., it is evident that 106 respondents participated in the study. A closer examination of the 106 respondents

shows that 67 were male and 39 were female. Further analysis revealed that for the web masters, there were 39 male respondents and 13 female respondents which represented 25 % of the webmasters. For the web developers, 28 were male and 26 were female which represented 48.1% of the web developers.

Status of respondent

Status	Frequency	Percent
Web masters	52	49.5
Web developers	54	50.5
Total	106	100.0

TABLE4: 2 DESCRIPTIVE STATISTICS ON STATUS OF THE RESPONDENTS

Table 4.2: Descriptive statistics on status of the respondents

Table 4.2 indicates that 52 (49.5%) of the respondents comprised of web masters and 54 (50.5%) the web developers. The total number of respondents that participated in the study was 106.

Years of experience in web development

Experience	Frequency	Percent
Below 1 year	24	22.6
1-3 years	30	28.3
3-5 years	17	16.1
5 years and above	35	33.0
Total	106	100.0

TABLE4: 3 DESCRIPTIVE STATISTICS ON RESPONDENTS EXPERIENCE IN WEB DEVELOPMENT

According to table 4.3 the respondents included those developers with experience with experience below 1 year which comprised of 24 (22.6%), 1-3 years' experience 30 (28.3%), 3-5 years' experience 17 (16.1%) and experience of 5 years and above at 35(33.0%). This includes respondents from both web masters and web developers of academic websites.

Educational level	Frequency	Percent
Certificate level	02	1.90
Diploma and above	46	43.3
Bachelors	53	50.1
Masters	04	3.80
PHD	01	0.90
Total	106	100.0

TABLE4: 4 DESCRIPTIVE STATISTICS ON THE EDUCATIONAL LEVEL OF THE RESPONDENTS

The study focused on respondents with different educational levels. According to the data presented in Table 4.4, it is evident that the majority (50.1%) of the respondents had a bachelor's degree which comprised of 53 respondents. It was followed by respondents with Diplomas and above which comprised of 43.3 %. The respondents with masters had 3.80% respondents that participated in the study. Respondents with certificate level had 1.90% and respondents with a PHD level, 0.5% which had the lowest number of respondents which have relatively fewer respondents compared to the rest of the respondents given questionnaires.

4.3. Analysis and Interpretation of Research Questions

Table4: 5 Descriptive statistics on respondent's assessment on the website usability

Items on Usability	N	Mean	Std. Deviation
Academic Websites developed ensures easiness of users to find way to information from the homepage?	106	3.88	0.973
Sites developed ensure users accurately predict which section of the website contains the information that he/she is looking for?	106	3.72	1.021
The homepage content of the websites developed makes a user want to explore the site further?	106	3.42	1.860
Is the website you develop well suited for first time visitors?	106	3.24	1.291
How do you rate the overall structure of the websites you develop? Are they straight forward?	106	3.53	1.266

From the descriptive statistics on respondents' assessment on usability, most of the respondents agreed with the fact that the academic websites developed ensures easiness of users to find way to information from the homepage with a mean of 3.88.

The item *'Is the website you develop well suited for first time visitors*?*'* had the lowest mean of 3.2360 implying that respondents neither disagree nor agreed with this item.

The item '*Sites developed ensures users accurately predict which section of the website contains the information that he/she is looking for*?' had a mean of 3.72 which implies that most of the respondents develop academic websites which predict to the user where to get the information that they are looking for.

The item '*The homepage content of the websites developed makes a user want to explore the site further*?*'* had a mean of 3.42. This implies that the homepage content needs to be well crafted so as to make the users always want to explore more from the site or come back or explore more on the academic website.

Table4: 6 Descriptive statistics on the respondents' assessment on the functionality of academic websites

Items on Functionality	N	Mean	Std. Deviation
Do the Academic websites developed contain administration tools which enhance efficiency? i.e. Help, FAQ, search	106	3.41	1.177
How do you rate all functionalities? Are they clearly labeled?	106	3.87	0.757
Do the Academic websites developed ensure that it is easy to navigate the website? I.e. options to return to home page, top of pages are provided.	106	4.02	1.163
Do you make linkages to other sites that have discussions on similar topics?	106	3.57	1.543
The selected graphics in the websites developed serve a functional purpose	106	3.50	1.244

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For the functionality of the website, the respondents agreed on the item *'Do the Academic websites developed ensure that it is easy to navigate the website? I.e. options to return to home page, top of pages is provided.'* that scored the highest

mean of 4.02. This means that the academic websites developed ensures that it is easy for users to go about or navigate through the web pages.

The item *'How do you rate all functionalities? Are they clearly labeled?'* indicated a mean of 3.87. These results indicate that the respondents agree to the clear labelling of academic website functionalities such that if one wants to access the online registration system, they know which label or link to click on.

Most of the respondents agreed on the item *'The selected graphics in the websites developed serve a functional purpose'* which scored a mean of 3.50 in this category. This means that most of the respondents were for the opinion that the graphics on the websites developed are of a functional purpose on the website while others agreed.According to Babak et al., (2012), the users of a website are interested in the quality of the website which is inclusive of the graphics used.The graphics on the website bring the world into your document in a concise and unforgettable way that saves that proverbial "thousand words" of explanation. Why describe something when you can simply and more memorably show it? The website graphics must be simple so that it does not interfere with the arrangement of the information presented. Patrick & Sarah (2011) indicate that graphics used on a website must not hinder web navigation, nor increase the time necessary for opening the website. The navigation must be intuitive and ergonomic. Fine graphics are accorded with all the other aspects of accessibility and applicability of the website.

The item *'Do the websites developed contain administration tools which enhance efficiency? I.e. Help, FAQ'* indicated the least mean of 3.41 in this category. This means that the respondents were neutral on this item. The Help and FAQ features are an important aspect of the website.FAQ pages aim to make finding answers easy for users. The ideal FAQ pages help users of the website without the need for outside assistance. More often than not, unfortunately, this ideal is not realized.This makes the website more user friendly than having to wait for responses from the helpdesk. Negi (2009) clearly points out that overall service quality is significantly associated with and contributes to the overall satisfaction of service consumers. These features enhance service provision, and if the consumers of the service are not satisfied with the available services, it has negative significances towards the overall consumer's satisfaction of the services.

Table4: 7 Descriptive statistics on respondent's assessment on the efficiency of academic websites developed.

Items on Efficiency	N	Mean	Std. Deviation
How do you rate the switch time between pages? Is it in real time?	106	3.92	1.096
The information posted on the website is always timely	106	3.30	1.220
How do you rate recoverability rate of your systems in the event of system failure or hacking?	106	3.45	2.266
The web services and functionalities are perfect	106	3.24	1.291
The websites developed offers feedback features for visitors	106	3.31	1.245

The item *'How do you rate the switch time between pages? Is it in real time?'* Scored a mean of 3.92 which was the highest scoring item in this category. This would mean that the respondents agreed to the fact that it is easy for them to navigate through the website.

The items *'the information posted on the website is always timely'* had a mean of 3.30 and *'the web services and functionalities are perfect'* which scored 3.24 respectively. This reveals that the respondents were neutral with these items, which means that both developers and web masters may not be interested in the timeliness of the posts on the website and that most of the information can be left on the website longer than it should as echoed by the need for content update.According to Ahmet and Aykut (2012) asserts that the web site represents an organization, communicating an organization's culture, values, and vision. An institutional web site acts as a delivery mechanism for services that facilitate various tasks a stakeholder needs to perform. The site also serves as a platform through which an organization can interact with its stakeholders hence the information posted on the website should be timely and much updated. Xin and Weiqi (2009) affirm that the functionality of a website entails the site's delivery of interactive services to all end users, and it's important to note that this includes both the public as well as the immediate users within the institution.

The item *'The websites developed offers feedback features for visitors'* scored a mean of 3.31. These results indicate that the respondents were neutral on this item. Whereas feedback from the user helps the service provides to improve on their weaknesses. Gour and Theingi (2009) argue that the service provider improves on the services provided so as to satisfy the needs of the consumer. Literature search

also indicates that any organization will gain a lasting competitive advantage if it pays attention to the satisfaction of the needs of the consumers. Customer feedback is the transmission of negative information (complaints) or positive information (compliments) to providers about the services used. Such information can be useful for providers in identifying areas in which adjustments of performance are required. According to Ahmet and Aykut (2012) affirms that continuous feedback from the users presents valuable input to universities to improve their web sites. In order to satisfy the constantly changing demands of the website users and improve the features of the website, university administrators may deploy a site intercept survey on their website and collect survey data. Gour & Theingi (2009) concluded that dissatisfied customers are significantly more likely to provide negative feedback than are satisfied customers to provide positive feedback. It is presumed that customers who provide negative feedback are seeking to achieve some form of compensation for unmet quality of services; in contrast, the provision of positive feedback is often perceived by customers as not being rewarded.

Table4: 8 Descriptive statistics on respondents' assessment on the reliability of the academic websites developed

Items on Reliability	N	Mean	Std. Deviation
The information on the academic websites are always consistent	106	3.54	1.131
The forms on the website are working	106	3.49	1.123
The academic websites may contain some broken links	106	3.03	1.215
Information on the academic websites is regularly updated	106	3.11	1.282
There are communication tools when the website is down.	106	2.43	1.096

The item '*the information on the academic website are always consistent*' scored the highest mean of 3.54, which indicate that most of the respondents agreed with this item. The item '*the academic websites may contain some broken links*' had a mean of 3.03 in this category, which reveals that the respondents were neutral to the fact that there are broken links on most academic websites.

These results concur with Pressman (2010), who indicates that the website software should be designed in such a way that they do not allow any intentional failure, wrong information and transaction errors meaning that the website should offer reliable services to the users. The website must be reliable in the information that it

provides to the public.The information posted on the website should always be consistent and it should not contain any broken links that frustrate the users.

The item '*information on the website is regularly updated* scored a mean of 3.11. These results indicate that the respondents were neutral on this item which would mean that the information on the website is not regularly updated or posted at the right time. The information that is up to date is more reliable to the users than outdated information. The results of this item indicate that according to what Nyambega (2010) points out on the Kenya Institutions website, not much has changed or improved so far.

The item '*There is communication tools when the website is down'* scored the lowest mean in this category. It scored a mean of 2.43, which means that the respondents disagreed with this item. That is, there is no need for communication when the website is down. Gour and Theingi (2009) argue that communication is very important between service providers and the consumers of that service.Website downtime are sometimes unavoidable. The key to managing the downtime properly is in maintaining communication with the website users. An outage that lasts for days is not acceptable unless there's a very good reason for the downtime. The reason, however, must be properly communicated to the website users.Effective communication helps build trust in the services that are being offered and the users are able to share their knowledge and experiences with the service providers. It is also important to informing the website users of any major website changes which is the best practice. When the website undergoes changes that may affect the user's ability to locate information, such as a website redesign, help the users locate information in the new format by explaining the changes because websites address a global audience, in a strongly competitive, "open" environment (Chingang and Lukong, 2010).

TABLE4: 9 DESCRIPTIVE STATISTICS ON RESPONDENT'S ASSESSMENT ON INTERFACE DESIGN OF ACADEMIC WEBSITES.

Items on interface design	N	Mean	Std. Deviation
The interface of the website developed is pleasant	106	3.46	1.205
We ensure that No pages are crowded with information	106	3.41	1.185
Similar fonts and colors are used throughout the developed site	106	2.43	1.096
Alignment of text and page elements are constant throughout the website	106	3.42	1.279

The analysis in this category indicated that a large number of the respondents were neutral on most of the items in this category. The item *'The interface of the website developed is pleasant'* scored the highest mean of 3.46, which means that most of the respondents were neutral on this item. The item "*Similar fonts and colors are used throughout the developed site*" had the smallest mean of 2.43 in this category.

Hassan (2008) states that, the interface design of the website must be attractive, enjoyable and pleasant enough to create an emotional appeal to the site. Yoo and Jin (2004) added that, the choice of the color, label names and font types used must be consistent throughout the website. Web pages should not also be overcrowded or overloaded; white spaces should be effectively used to avoid overcrowded pages.

TABLE4:10 DESCRIPTIVE STATISTICS ON RESPONDENT'S ASSESSMENT ON THE SECURITY OF ACADEMIC WEBSITES DEVELOPED.

Items on Security	N	Mean	Std. Deviation
We ensure that the users are aware of the security policies regarding information protection in the institutional website	106	3.24	1.176
The academic website developed is well protected.	106	3.42	1.233
The academic website developed is protected from malicious attacks	106	3.58	1.264

The academic website protects unauthorized modification to information	106	3.47	.795
The academic website developed is secure so as to avoid loss of information	106	3.51	.969

The analysis in this category reveals that the respondents are neutral with most of the items in this category. The item *'The academic website developed is protected from malicious attacks'* scored the highest mean of 3.58. This reveals that the respondents are aware of the website protection against malicious attack.

The item *'we ensure that the users are aware of the security policies regarding information protection in the institutional website'* had a mean of 3.24. This item scored the least mean which indicate that most of the respondents are not aware of the security policies regarding the protection of information on the website. These results are affirmed by what Waters (2009) arguments, that educational institutions must have clear policies that are related to information protection and that the users of the information should be aware of these policies. This should be implemented in all educational institutions but lack of training on these policies is the major problem which may also lead to other risks such as data theft or other security holes within the system.

The items *'The academic website developed is well protected'* had a mean of 3.42; *'The academic website protects unauthorized modification to information'* had a mean of 3.47. .According to Myungee (2009) a website often collects and stores a variety of sensitive, personal information about its customers in order to better serve them in their future visitation thus web services should be delivered and operated in a reliable and dependable manner to build trust and confidence from customers.

"Security training is at the heart of writing good code", writes John Heimann of Oracle (Heimann, 2006). For organizations that make available internet connected systems to the public for use, security training is a must have and is often overlooked in many developers backgrounds. "It's an unfortunate fact that most developers are not required to learn secure coding practices in school" (Kuzma et al., 2010). Many at times within academia and within the corporate world the focus in educating developers is on creating efficient bug free code. Security checks are optional at best and are rarely considered an ignored.

TABLE4: 11 DESCRIPTIVE STATISTICS ON RESPONDENT'S ASSESSMENT ON THE CONTENT OF ACADEMIC WEBSITES.

Items on content quality	N	Mean	Std. Deviation
The content on the website is regularly updated	106	3.35	1.074
The information provided in the website is clear (not ambiguous)	106	3.63	1.036
I think the website provides important information to students	106	3.72	1.085
It is easy to find information about upcoming events in the academic websites	106	3.29	1.352
Author names of pages are available	106	3.13	1.468

The analysis in this category indicated the following results on content quality of academic websites. The item '*I think the website provides important information to students*' had the highest mean of 3.72 with a standard deviation of 1.085. The results from this item indicate that the respondents agree to the fact that the information posted on the website is important to students.

The item '*the content on the website is regularly updated*' had a mean of 3.35 with a standard deviation of 1.074. Roberto (2012) argues that the content of a website should be considered to be the most important thing. It helps in determining how effective a website is. Fresh and unique website content is a very important factor in encouraging people to revisit your site more often. Content is king.

Further, Roberto (2012) argues that the website users are usually concerned with ease of use of the features, the aesthetic features and its specific user oriented content. Nwankwo (2007) observes that poor content quality from an internal service department of an institution to internal customers can exert negative influence on the quality of service offered to the external customer such as students or alumni, in higher education settings.

The item '*Author names of pages are available*' had a mean of 3.13 with a standard deviation of 1.468. This reveals that most pages in the academic websites lack page authors.

Descriptive statistics on respondents weights assigned to the research parameters given the range of 1-5 where 5 is the most important and 1 the least important

Table4: 12 Descriptive statistics on RESPONDENTS WEIGHTS assigned to the research parameters

Research Parameters	N	Mean	Std. Deviation
Usability	106	4.01	1.009
Functionality	106	3.92	.896
Reliability	106	3.80	.920
Efficiency	106	3.90	1.112
Security	106	3.57	1.155
Interface design	106	3.79	1.030
Content	106	3.87	.904

Descriptive statistics on the respondents' weights were as follows: Usability (mean, 4.01and standard deviation, 1.009, Functionality (mean, 3.92 and standard deviation, .896), Reliability (mean, 3.80 and standard deviation .920), efficiency (mean, 3.90 and standard deviation 1.112), Security (mean, 3.57 and standard deviation 1.155) and interface design (mean 3.79 and standard deviation 1.030).

From the analysis from the Table 4.12, the respondents are more concerned with the usability of the website. Ahmet and Aykut (2012) emphasize that website usability is conencerned with how easy and intuitive it is for individuals to learn how to use and interact with the website.It is a measure of the quality of a website as it is perceived by the users. Usability is greatly associated with a positive attitude toward the website (Nor & Tun 2008).That is, the information of the websites' homepage should be easy to find for all the users whether first time visitors or those that have used it before. The users should be able to predict which section of the website contains the information that they are looking for very fast.

The results on the security of the website which had the lowest mean of 3.57 would change if the respondents were aware of the security policies that govern institutional websites.

4.4: Inferential statistical analysis for web developers and web masters

This section presents inferential statistics of respondents using Analysis of Variance (ANOVA) using p-values.

Group descriptive statistics on Usability

Table4: 13 Group descriptive statistics on Usability

Status of respondent		Academic Websites developed ensures easiness of users to find way to information from the homepage?	Sites developed ensure users accurately predict which section of the website contains the information that he/she is looking for?	The homepage content of the websites developed makes a user want to explore the site further?	Is the website you develop well suited for first time visitors?	How do you rate the overall structure of the websites you develop? Are they straight forward?	Mean of Usability variables
Web Developers	Mean	3.78	3.70	3.43	3.20	3.57	3.54
	N	54	54	54	54	54	54
	Std. Deviation	.965	.944	.860	1.337	1.283	1.078
Web Masters	Mean	3.98	3.73	3.40	3.27	3.48	3.57
	N	52	52	52	52	52	52
	Std. Deviation	.980	1.105	.869	1.254	1.260	1.094
Total	Mean	3.88	3.72	3.42	3.24	3.53	3.56

N	106	106	106	106	106	106
Std. Deviation	.973	1.021	.860	1.291	1.266	1.082

Group descriptive statistics on Usability indicated by Table 4.14 were as follows: web developers (mean 3.54 and standard deviation of 1.078) and Web Masters (mean 3.57 and standard deviation of 1.094). Web masters had the highest mean on this parameter which could be attributed to their continuous interaction everyday with the users of the website.

Analysis of variance (ANOVA) on Table 4.14 shows that the combined effect of item 1, item 2, item 3, item 4 and item 5 were statistically significant in determining usability quality attribute of an academic site. This is demonstrated by p values less than the acceptance critical value of 0.05.

ANOVA Analysis on Usability

Table4: 14: ANOVA Analysis on Usability

			Sum of Squares	df	Mean Square	F	Sig.
Academic Websites developed ensures easiness of users to find way to information from the homepage?* Status of respondent	Between Groups	(Combined)	14.056	2	7.028	7.589	.001
	Within Groups		363.043	104	.926		
	Total		377.099	106			
Sites developed ensures users accurately predict which section of the website contains the information that he/she is looking for?* Status of respondent	Between Groups	(Combined)	3.152	2	1.576	1.525	.021
	Within Groups		405.015	104	1.033		
	Total		408.167	106			

The homepage content of the websites developed makes a user want to explore the site further?* Status of respondent	Between Groups	(Combined)	35.010	2	17.505	13.011	.000
	Within Groups		527.385	104	1.345		
	Total		562.395	106			
Is the website you develop well suited for first time visitors?* Status of respondent	Between Groups	(Combined)	51.119	2	25.560	20.554	.000
	Within Groups		487.453	104	1.244		
	Total		538.572	106			
How do you rate the overall structure of the websites you develop? Are they straight forward?* Status of respondent	Between Groups	(Combined)	6.230	2	3.115	2.787	.003
	Within Groups		438.124	104	1.118		
	Total		444.354	106			

Group descriptive statistic on Functionality

Status of respondent	Do the websites developed contain administration tools which enhance efficiency? i.e. Help, FAQ	How do you rate all functionalities? Are they clearly labeled?	Do the Academic websites developed ensure that it is easy to navigate the website? I.e. options to return to home page, top of pages are provided.	Do you make linkages to other sites that have discussions on similar topics?	The selected graphics serve a functional purpose	Mean of functionality variables

Web developers	Mean	3.46	3.91	4.09	3.50	3.57	3.67
	N	54	54	54	54	54	54
	Std. Deviation	1.209	.734	1.321	1.489	1.143	1.179
Web Masters	Mean	3.35	3.83	3.94	3.63	3.38	3.63
	N	52	52	52	52	52	52
	Std. Deviation	1.153	.785	.978	1.609	1.174	1.140
Total	Mean	3.41	3.87	4.02	3.57	3.48	3.71
	N	106	106	106	106	106	106
	Std. Deviation	1.177	.757	1.163	1.543	1.157	1.159

TABLE4: 15 GROUP DESCRIPTIVE STATISTICS ON FUNCTIONALITY

Group descriptive statistics on functionality indicated by Table 4.15 were as follows: Web developers (mean3.63, and standard deviation of 1.179) and web masters (mean 3.71 and standard deviation of 1.140). The Web masters had the highest mean on this parameter which could be attributed to the daily interaction of the academic website from their work station on a daily basis.

An ANOVA was employed to determine the user's assessment on the functionality of the website. Item 1 yielded a p-value of .004, item 2 - .001, item 3 - .018 and item 5 - .007 which is less than the significance level of .05. This indicates that the respondents assessed this item differently. Item 4 yielded a p-value of .561which is higher than the critical acceptance value of 0.05. This would be attributed to the fact that respondents did not prefer linkages to other sites with similar discussions.

ANOVA Analysis on functionality.

			Sum of Squares	df	Mean Square	F	Sig.
Do the websites developed contain administration tools which enhance efficiency? i.e. Help, FAQ* Status of respondent	Between Groups	(Combined)	13.473	2	6.736	5.719	.004
	Within Groups		461.758	104	1.178		
	Total		475.230	106			
How do you rate all functionalities? Are they clearly labeled?* Status of respondent	Between Groups	(Combined)	79.036	2	39.518	7.513	.001
	Within Groups		2061.885	104	5.260		
	Total		2140.922	106			
Do the Academic websites developed ensure that it is easy to navigate the website? I.e. options to return to home page, top of pages is provided.* Status of respondent	Between Groups	(Combined)	15.680	2	7.840	4.086	.018
	Within Groups		752.229	104	1.919		
	Total		767.909	106			
Do you make linkages to other sites that have discussions on	Between Groups	(Combined)	53.625	2	26.812	5.016	.561
	Within Groups		2095.479	104	5.346		

similar topics?* Status of respondent	Total		2149.104	106			
The selected graphics serve a functional purpose * Status of respondent	Between Groups	(Combined)	1.255	2	.628	.578	.007
	Within Groups		425.444	104	1.085		
	Total		426.699	106			

TABLE4: 16 ANOVA ANALYSIS ON FUNCTIONALITY.

The descriptive statistics on Efficiency indicated by Table 4.17 below were as follows: Web developers (mean, 3.43 and standard deviation of 1.185) and web masters (mean 3.46 and standard deviation of 1.265). This means that the respondents in the two categories were neutral in this category.

Group descriptive statistics on Efficiency

Status of respondent		How do you rate the switch time between pages? Is it in real time?	The information posted on the website is always timely	How do you rate recoverability rate of your systems in the event of system failure or hacking?	The web services and functionalities of the sites developed are perfect	The websites developed offers feedback features for visitors	Mean of efficiency variables
Web	Mean	3.80	3.35	3.50	3.22	3.28	3.43

developers	N	54	54	54	54	54	54
	Std. Deviation	1.122	1.152	1.060	1.327	1.265	1.185
Web Masters	Mean	4.04	3.25	3.40	3.25	3.35	3.46
	N	52	52	52	52	52	52
	Std. Deviation	1.066	1.297	1.459	1.266	1.235	1.265
Total	Mean	3.92	3.30	3.45	3.24	3.31	3.44
	N	106	106	106	106	106	106
	Std. Deviation	1.096	1.220	1.266	1.291	1.245	1.224

TABLE4: 17GROUP DESCRIPTIVE STATISTICS ON EFFICIENCY

Analysis of variance (ANOVA) on Table 4.18 shows that the combined effect of item 1, item 3, item 4 and item 5 are statistically significant in determining efficiency quality attribute of an academic site. This is demonstrated by p values less than the acceptance critical value of 0.05.

ANOVA Analysis on efficiency.

			Sum of Squares	df	Mean Square	F	Sig.
How do you rate the switch time between	Between Groups	(Combined)	32.510	2	16.255	13.921	.000
	Within Groups		457.733	104	1.168		

pages? Is it in real time?* Status of respondent	Total		490.243	106			
The information posted on the website is always timely * Status of respondent	Between Groups	(Combined)	9.579	2	4.789	3.749	.064
	Within Groups		500.765	104	1.277		
	Total		510.344	106			
How do you rate recoverability rate of your systems in the event of system failure or hacking?* Status of respondent	Between Groups	(Combined)	73.283	2	36.642	6.978	.001
	Within Groups		2058.403	104	5.251		
	Total		2131.686	106			
The web services and functionalities of the sites developed are perfect * Status of respondent	Between Groups	(Combined)	19.466	2	9.733	9.191	.000
	Within Groups		415.107	104	1.059		
	Total		434.572	106			

The websites developed offers feedback features for visitors * Status of respondent	Between Groups	(Combined)	11.617	2	5.808	4.640	.010
	Within Groups		490.702	104	1.252		
	Total		502.319	106			

TABLE4: 18 ANOVA ANALYSIS ON EFFICIENCY.

Descriptive statistics on Reliability (Table 4.19) were as follows: web developers (mean, 3.54 and standard deviation of 1.150), web masters (mean, 3.34 and standard deviation of 1.122) Web developers indicated the highest mean which could be attributed to them being comfortable with the content presented in terms of consistency, the availability of working forms on the website as well as availability of communication tools when the academic sites is down. This could be enhanced by the fact that they are able to develop several websites due to the nature of their work.

Group descriptive statistics on Reliability

Table4: 19 Group descriptive statistics on Reliability

		The information on the academic websites are always consistent					
Web developers	Mean	3.87	3.83	3.78	3.19	3.02	**3.54**
	N	54	54	54	54	54	**54**

	Std. Deviation	1.117	1.023	1.058	1.333	1.221	**1.150**
Web Masters	Mean	4.19	3.23	3.19	2.87	3.21	**3.34**
	N	52	52	52	52	52	**52**
	Std. Deviation	.908	1.165	1.121	1.067	1.348	**1.122**
Total	Mean	4.03	3.54	3.49	3.03	3.11	**3.44**
	N	106	106	106	106	106	**106**
	Std. Deviation	1.028	1.131	1.123	1.215	1.282	**1.156**

An ANOVA was employed to determine the respondents' assessment on the reliability of the website. Item 2 yielded a p-value of .007 and item 3 - .007. This indicates that there is no difference in the respondents' assessment on these items. Item 1 yielded a p-value of .011, item 4 - .187 and item 5 - .012. These three items indicate that there is a difference in the respondents' assessment of these items. These would be attributed to the canvassing knowledge on the reliability attributes of academic websites and the services that academic websites are meant to offer.

ANOVA Analysis on Reliability.							
			Sum of Squares	df	Mean Square	F	**Sig.**
The information on the academic websites are always consistent * Status of respondent	Between Groups	(Combined)	49.659	2	24.830	4.533	**.011**
	Within Groups		2147.212	104	5.478		

	Total		2196.871	106			
The forms on the website are working * Status of respondent	Between Groups	(Combined)	3.360	2	1.680	1.749	**.007**
	Within Groups		376.614	104	.961		
	Total		379.975	106			
The academic websites may contain some broken links * Status of respondent	Between Groups	(Combined)	1.455	2	.727	.707	**.007**
	Within Groups		403.279	104	1.029		
	Total		404.734	106			
Information on the academic websites is regularly updated * Status of respondent	Between Groups	(Combined)	3.729	2	1.865	1.685	**.187**
	Within Groups		433.774	104	1.107		
	Total		437.504	106			
There is communication tools when the website is down.* Status of respondent	Between Groups	(Combined)	10.955	2	5.477	4.579	**.012**

			Within Groups	468.919	104	1.196		
			Total	479.873	106			

TABLE4: 20 ANOVA ANALYSIS ON RELIABILITY.

From the analysis on Table 4.21on interface design the means of the two groups were as follows: web developers (mean, 3.16 and standard deviation of 1.190) and web masters (mean 3.19 and standard deviation of 1.196). These results indicate that the respondents from the two categories neither agreed nor disagreed with the items on interface design.

Group descriptive statistics on interface design

	Status of respondent			The interface of the website developed is pleasant	We ensure that No pages are crowded with information	Similar fonts and colors are used throughout the developed site	Alignment of text and page elements are constant throughout the website	**Mean of interface design variables**
Web developers			Mean	3.37	3.35	2.50	3.43	**3.16**
			N	54	54	54	54	**54**
			Std. Deviation	1.023	1.058	1.333	1.221	**1.190**
Web Masters			Mean	3.56	3.44	2.37	3.40	**3.19**
			N	52	52	52	52	**52**
			Std. Deviation	1.165	1.121	1.067	1.348	**1.196**
Total			Mean	3.46	3.41	2.43	3.42	**3.18**
			N	106	106	106	106	**106**
			Std. Deviation	1.205	1.185	1.096	1.279	**1.193**

TABLE4: 21GROUP DESCRIPTIVE STATISTICS ON INTERFACE DESIGN

An ANOVA was employed to determine the respondents' assessment on the interface design factor of the website. Item 1 yielded a *p*-value of .001, Item 2, .034

item 3, .000 and item 4 .000. These results indicate that the combined effect of item 1, item 2, item 3 and item 4 are statistically significant in determining interface design quality attribute of an academic site. This is demonstrated by p values less than the acceptance critical value of 0.05.

Table4: 22 ANOVA Analysis on interface design.

		Sum of Squares	df	Mean Square	F	sig
The interface of the website developed is pleasant	Between Groups	83.170	2	41.585	7.159	**.001**
	Within Groups	2276.971	104	5.809		
	Total	2360.142	106			
We ensure that No pages are crowded with information	Between Groups	8.992	2	4.496	3.411	**.034**
	Within Groups	516.745	104	1.318		
	Total	525.737	106			
Similar fonts and colors are used throughout the developed site	Between Groups	30.336	2	15.168	9.973	**.000**
	Within Groups	596.211	104	1.521		
	Total	626.547	106			
Alignment of text and page elements are constant throughout the website	Between Groups	24.336	2	12.168	8.772	**.000**
	Within Groups	543.740	104	1.387		
	Total	568.076	106			

Descriptive statistics on Security table 4.23 below were as follows: web developers (mean, 3.36 and standard deviation of 1.073) and Web masters (mean, 3.53 and standard deviation of 1.081). The web masters scored the highest mean in this category which could be attributed to them having some little knowledge on security issues but generally the items on this category scored neutrally. An ANOVA (Appendix 1) was employed to determine the respondents' assessment on the security factor of an academic website. Item 2 yielded a *p*-value of .098, item 4 - .200 and item 5- .646. These results indicate that there is a difference in the

respondents' assessment on these items. Even though the respondents were neutral on items in this category these results indicate that correspondents weigh these items differently indicated by the significance difference given in the results. Item 1 yielded a *p*-value of 0.041 and item 3- .027 this indicates that there is no difference in the respondents' assessment on this item. The respondents' from the two categories indicate that the respondents' are aware that the website needs security policies as well as protection from malicious attacks

Table4: 23 Group descriptive statistics on Security

Status of Respondent		We ensure that the users are aware of the security policies regarding information protection in the institutional website	The website developed is well protected.	The academic website developed is protected from malicious attacks and hacking	The academic website protects unauthorized modification to information.	The academic website developed is secure so as to avoid loss of information	Mean of security variables
Web developers	Mean	3.04	3.54	3.48	3.46	3.26	**3.36**
	N	54	54	54	54	54	**54**
	Std. Deviation	1.213	1.059	1.342	.794	.955	**1.073**
Web Masters	Mean	3.44	3.29	3.69	3.48	3.77	**3.53**
	N	52	52	52	52	52	**52**
	Std. Deviation	1.110	1.391	1.181	.804	.921	**1.081**

Total	Mean	3.24	3.42	3.58	3.47	3.51	**3.44**
	N	106	106	106	106	106	**106**
	Std. Deviation	**1.176**	**1.233**	**1.264**	**.795**	**.969**	**1.087**

Group descriptive statistics on content characteristics of an academic site indicated by Table 4.24 were as follows: Web developers (mean 3.33, and standard deviation of 1.208) and web masters (mean 3.53 and standard deviation of 1.178). The Web masters had the highest mean on this parameter which could be attributed to the daily interaction of the academic website content which is part of their job description Analysis of variance (ANOVA) (Appendix 2) on content quality of an academic website showed that the combined effect of item 1, item 2, item 3 and item 5 are statistically significant in determining content quality attribute of an academic site. This is demonstrated by p values less than the acceptance critical value of 0.05.

Table4: 24 Group descriptive statistics on Content

Group descriptive statistics on Content

Status of respondent	The content on the website is regularly updated	The information provided in the website is clear (not ambiguous)	I think the website provides important information to students	It is easy to find information about upcoming events in the academic websites	Author names of pages are available	**Mean of content variables**

Web developers	Mean	2.93	3.22	3.69	3.72	3.07	**3.33**
	N	54	54	54	54	54	**54**
	Std. Deviation	1.552	1.383	1.163	.899	1.043	**1.208**
Web Masters	Mean	3.35	3.37	3.75	3.54	3.65	**3.53**
	N	52	52	52	52	52	**52**
	Std. Deviation	1.356	1.329	1.007	1.163	1.036	**1.178**
Total	Mean	3.13	3.29	3.72	3.63	3.35	**3.42**
	N	106	106	106	106	106	**106**
	Std. Deviation	1.468	1.352	1.085	1.036	1.074	**1.193**

Respondents' opinions of quality improvements characteristics that they would like to be included in institutional websites (Item 12 on the questionnaire)

Question 12 asked the respondents to list their opinions of the improvements they would want to see on institutional websites. In asking this question, the research meant to give an opportunity to the respondents to air their views on the quality factors of academic websites. The respondents had a lot to say on this question but most of the comments were grouped into five themes. This included security, content update, attractiveness, interactivity and ease of use. Most of the responses were very similar but they revolved around these themes and some responses were as indicated below:

Content update

- Should be reliable and not always containing same features
- Should have recent information
- Current updates which should be timely
- Pictures of various schools and departments and make it simple
- The student handbook should be availed
- Improvement in the updates, based on all activities in the institutions .News discussed in meetings and even daily blogs.
- Update the staff and faculty profiles and each department message and photographs
- More information about everything happening in the university
- Change cover photo/Change the website cover often enough. Not one photo at a cover for diversity for long
- Enable downloading of financial statements
- Academic calendar of events, updates on university operations
- The university journals, research papers should be included in the site
- A lot of research sites which are going to be easily accessible on the website
- Timely updates of new events
- Update more often and include research findings by both faculty and students
- Pulling down of old images

Reliability

- Most sites are slow ,some improvements should be added for it to work faster
- Connection should be improved
- Recover quickly incase hacked

Interactivity

- Should have a place where the opinions can be sent

- An interactive blog for each department to use to communicate and a general blog that allows administrative notices to be passed
- Student mails should be made accessible to all students. Guides on how to get required information
- A discussion board with interactive enabled features

Security

- Should improve its security
- Avoid use of freeware
- Should not be hackable

Ease of use

- The information should be easy to understand
- Include a how-to-use tutorial clip on the site
- More clarification of details which are useful to new student's e.g. online registration for admission into the institution.
- Clearly show the map and directions of various structures in the university and indicate the functions and purpose of the buildings
- More colorful and efficient
- Relevant information and ease of access to information especially on home page
- Improve on ease of use for first time users
- Cater for the needs of physical/disabled persons.
- Various language interpretation
- Make it more user friendly
- E-learning portals should be easy to learn
- Use of the website for e-learning

The response to this questions were tabulated as per each theme, and the results were as indicated below; 8% of the total respondents pointed out more concerns on the improvement on the security of the academic websites, 41% of those who responded to this question indicated concerns with the updating of the content on the

academic websites, 23% of the respondents had concerns with the timely posting of important information on academic websites, 14% of the respondents indicated concern with the interactivity of academic websites, 12 % on the ease of use by first time visitors, 2% on changes of language preferences where some of the respondents indicated the same opinions. From the data represented above, content update was a major concern that the respondents pointed out as a major issues in most academic sites.

Respondents' opinions on attributes that should be considered in evaluating academic websites (Item 13 on the questionnaire)

Question 13 asked the respondents to list any parameter (attribute) that they think should be considered in evaluating the quality of academic websites. A total of 34 (32%) respondents outlined their opinions. The representations from each category of respondents; 15 (44%) were web developers and 19 (56%) web masters. The responses given in this question were similar to answers given to Question 12. The recurring responses from the respondents were as following:

- Standby help
- Navigation of the website
- Interactivity

The responses on this questions were summarized as follows; 15 (14%) of the respondents indicated interactivity of the website with the users as one of the parameters that should be used to evaluate the website. Most of the respondents indicated that it was important for other stakeholders to be involved in evaluating the website. 10 (28%) of the web masters respondents and 16 (54%) respondents who are developers indicated feedback or timely response to questions as an attribute that should be used in assessing the website. The majority of the respondents 21 (71%) indicated that if improvements are made on the parameters used in the study the academic website will be excellent.

CHAPTER FIVE

ACADEMIC WEBSITE QUALITY EVALUATION MODEL

5.1 Model sub characteristics generation, analysis and discussions

This section gives a brief explanation of how the sub characteristics under each high level characteristic were compiled and regrouped under each high level characteristic. From the inferential statistics done on all the sub characteristics, it was found that some items on the questionnaire describing the various sub characteristics were found significant and thus contributed to the overall academic website quality and those that were found not significant will be discarded in the development of the proposed model. After each Top level quality Characteristic items in the questionnaire the researcher asked the respondents to list any other attribute that they thought should be considered in evaluating the quality of academic websites. The following observations were made that guided the adoption of the low level sub characteristics.

From the data items analyzed on usability it was found that all the items were found to be statistically significant, that is less the critical p-value of 0.05. With regard to usability the following attributes were considered:-

I.   **Understandability**- That is, helps users understand the overall structure of the academic website. The academic website must assist the first time visitors how to easily navigate around the academic site. This also include use of understandable terms, i.e. label terms must be simple as well as the terminologies used.

II. **Multiple language support** – the academic website should allow changing from one language to another. This is to support all users from diverse international countries.

III. **Interactivity**- FAQ's, contacts information, live support and any other tool that facilitates interactions should be made available.

IV. **Straightforwardness** – the overall structure of the academic website should be straight forward.

V. **Learnability**- learning how to use an academic site should be as easy as possible

VI. **Operability**- operating an academic website should not be an uphill task. The user should be in full control during the moment of use

The above usability attributes were analyzed and a correlation of 0.83 was obtained. This attributes were considered important since they majorly look at easiness of users to find way to information from the homepage, easy prediction of sections in the academic site, how the homepage content of the websites developed makes a user want to explore the site further, suitability for first time visitors as well as the straightforwardness of the site, which are all important aspects in quality evaluation of an academic site.

Functionality item number four in the question was found not to be statistically significant with a p-value of 0.561, while the rest of the items were found to be statistically significant with p-values less than 0.05. The sub characteristics adopted for functionality attributes which include include the following;-

I. **Search and retrieval** – Search buttons should be availed in all pages of the academic website so that the entire user should not always go back to the homepage for search and retrieval. Search options should also be included so that a website user can easily search by using category classification such as Course ID, Department, faculty etc.

II. **Navigation** – the academic website should have clear and consistent navigation to act as a roadmap to the user. It should always be easy to locate the current location, going back to the homepage as well as Backward Navigation.

III. **Interoperability**- the WebPages of the academic websites should be viewable in various web browsers, compatible with various operating systems and various device screens such as Phones, tablets and various computing devices and different screen settings.

The correlation analysis of functionality characteristic items were found to be 0.86. This shows that there is a close linear association between items considered under

functionality.Functionality in academic website since it entails how the public users interact with the site for services and the site's delivery. The functions indicate specific tasks that help to accomplish stated or implied needs. This includes developing sites which contains administration tools which enhance efficiencies. Help, FAQ, clear labeling of all functionalities, websites that ensure easiness to navigate the website I.e. that is where options to return to home page as well as back to top of page is provided and graphics which serve a functional purpose.

From the data analyzed, efficiency items considered was found to have a correlation function of 0.87. This shows a positive correlation between items considered under efficiency. The sub characteristics considered had a p-value less than the critical value of 0.05. The efficiency attributes considered include:-

I. **Load ability** – load time should be reasonable usually 3-15 seconds.
II. **Feedback** - The academic websites developed should offer feedback features for visitors.
III. **Accessibility** -The academic websites should be technically capable of ensuring and supporting people with different disabilities to access the website. This also includes avoidance of plug-ins and proprietary software extensions.

Efficiency deals with the number of clicks that a user makes so as to complete a particular tasks as well as how much time a user takes or how many actions a user will perform to complete a task or reach a particular goal (Teresa 2011). Therefore in developing academic website thorough considerations must be put to ensure that the sites developed takes a small amount of time to load or perform tasks. Users should be able to open pages within a few clicks.

The results for reliability items considered indicated a p-value less than the critical p-value less than 0.05 and a correlation function of 0.80. This results shows that there was a significant, positive and strong relationships among the attributes considered under reliability. The attributes considered for the reliability high level quality characteristics are:

I. **Recoverability**- This is the ability of an academic website to recover to its point of failure. The site should take the minimal mean time to recover back to its initial stage after an error occurred.

II. **Fault tolerance** – the academic website should be fault tolerant and respond gracefully to any unexpected failure. This should include unavailability of invalid links and every link should take a user to a valid page as well as communication tools when the academic website is down.

III. **Information consistency**- The information on the academic websites should always consistent

IV. **Availability** – minimize downtimes and uptimes. The academic website should be available 24/7/365

Reliability was considered in the development of an academic website framework since reliability is majorly concerned with the performance of a website. Reliability is all about the performance of an academic website, this performance starts with sites which are always available to users, with the ability to recover quickly in the event of system failure or hacking. This also might include timely and consistent posting of information as well as fault tolerance which ensure valid links and communication tools in cases when the academic website is down.

Results indicated that there was significant relationships among interface design attributes with a p-value <0.05 and a correlation function of 0.79. This shows that there is a close linear association between the items considered under interface design. Interface design will be evaluated based on the following attributes.

I. **Aesthetics** - The interface of the website developed should be pleasant, attractive, appealing and have a sense of happy satisfaction.

II. **No page overcrowding**- ensure that No pages are crowded with information.

III. **Consistent page alignment**- Alignment of text and page elements should be constant throughout the website

IV. **Similar fonts and colors** - Similar fonts and colors should be used throughout the academic site

These attributes in an academic website are important in that the user interface a website ought to be nice-looking, pleasing and enjoyable enough for consumers to form an emotional appeal while using the site. In totality, the choice of color, label names and font types used must be consistent throughout the website. Except for titles, the fonts used should be the same throughout the website. The WebPages should not also be overcrowded or overloaded; white spaces should be effectively used to avoid overcrowded pages.

From the data analyzed, only two attributes were considered. The two attributes had a p-value less than the critical value of 0.05. The calculated correlation value was 0.71. This implies that there is a significant relationship between policies and protection against hacking in an academic website. The following attributes were considered in security.

I. **Policies**- users should be made aware of the security policies regarding information protection in the institutional website

II. **Protection against hacking** - The academic website developed should be protected from malicious attacks and hacking. This includes protection from unauthorized modification of information. The website should be secure to avoid loss of information.

The security aspect of an academic website is important since more and more attacks are targeting security flaws in the design of web applications, such as injection flaws, traditional network security protection may not be sufficient to safeguard applications from such threats. Therefore we need to ensure that there are security policies regarding information protection in the institutional websites. We therefore need to protect academic websites from malicious attacks and hacking; we also need to ensure no unauthorized modification of information posted and no loss of information as well. The attributes considered under security involves:

The attributes of content considered had p-values less than the critical value less than 0.05.The correlation of the content function was found to be 0.98459.The following attributes were considered:-

I. **Currency-** The content on the website should be regularly updated. This should also include display of date when the content was created, up-to-date news section, indication of upcoming events and authors of information as well as any references

II. **Accuracy**- The information provided in the website should be accurate, clear, not ambiguous. Grammar and spelling errors should be avoided so as not to bring any confusion to users.

III. **Authority**- Authors of pages should be available. This should fully provide identifications and not credential for the author. The university distinctiveness should also be present, that is, logo, slogan and copyright.

IV. **Relevance** - the information should be user-oriented, all-inclusive, appropriate and within the expected level of detail.

The data shows that the sub-characteristics considered under content were strongly linked and therefore their use and their inclusion in the evaluation of an academic website would greatly improve the quality in terms of content. This is considered more important since Information provided in the website should be relevant and engaging to users. Unless the information in the website is important to students, the interest to use the website may decrease. Users rely on the information in the website and hence it is important to ensure the accuracy of the information made available on the website. Information academic websites include contact information of professors, information about particular upcoming activity, news about the university and the like. The information should be correct and that it does not mislead students. Grammar and spelling errors that could alter the meaning of the information should be avoided.

The website must have recent information related to current situations in the institution. There should also be some way for users to know that the website information was recently. This will help the users recognize the time when the information was updated and hence understand the situations of that particular time.

The information about authors who update the contents of pages in the website should be made available for references in case of any issue. Making available these information increase the trustworthiness of the content posted.

The implication of this findings indicate that the quality of an academic website cannot be determined by a single factor but through several characteristics with various attributes and different desire weights.

The high level quality characteristics and their low level sub quality characteristics will be represented in the figure below:
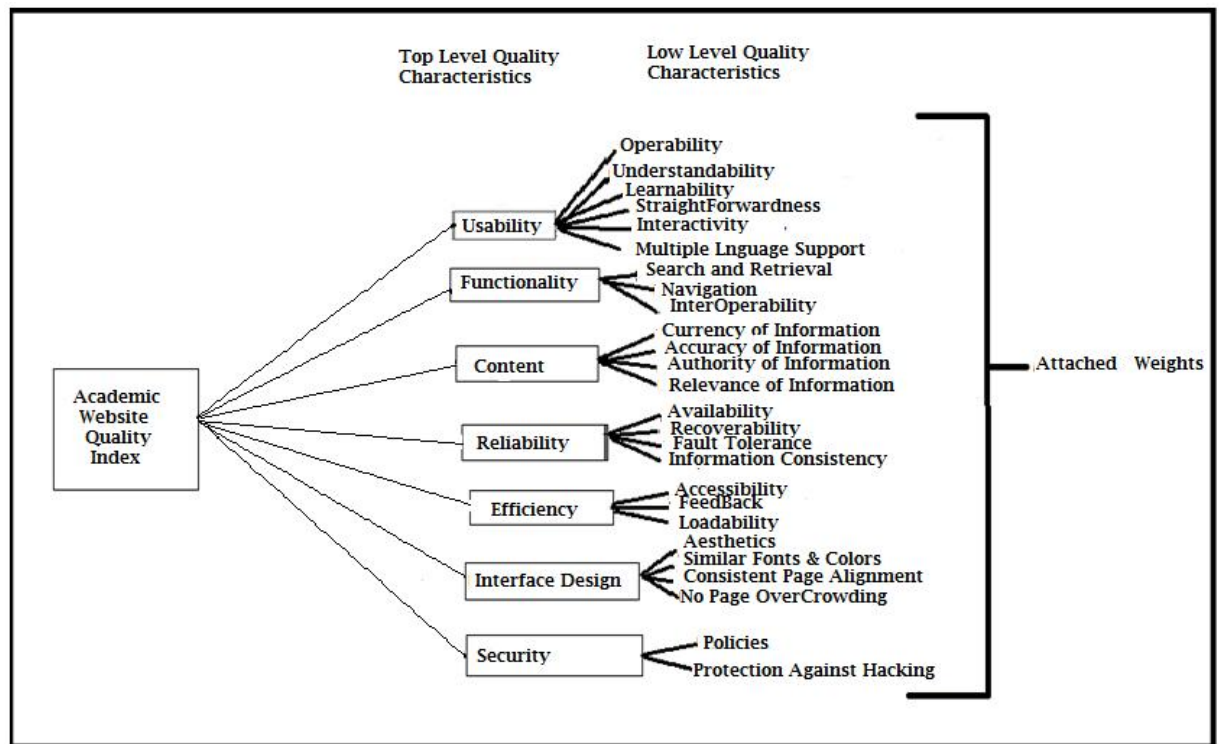
Figure 5:1 Representation of model framework

This figure above represents a proposed academic website quality evaluation model for evaluating quality in academic websites that considers seven high level quality characteristics: Usability, Functionality, Reliability, Efficiency, Content, interface design and Security – coupled with sub characteristics as the main determinants of quality in each high level Quality characteristics.

5.2 Interpretation of quality model desire weights generation

One of the objectives of this study was to attach desire weights for each quality sub characteristic identified for the proposed academic website quality evaluation model.

The weights are obtained from the data collected from the web masters and web developers who were considered as the key informants in this research work.

As earlier mentioned some quality sub characteristics are deemed more important than others and therefore it quite relevant to differentiate those sub characteristics that carry more weights in the quality evaluation of an academic website. This is only possible by attaching weights based on the desires attached to each sub characteristic based on the data collected in this research work.

The researcher used an interpretation scale to analyse and interpret the results of the research where the researcher inquired from the respondents to show their level of agreement to a given statement. Then, a desire weight for each response of the questions is assigned according to the responses as shown in the table below.

Range	Likert-scale	Interpretation Scale
5.00	Strongly agree	Agree
4.00	Agree	
3.00	Neutral	Neither Agree nor Disagree
2.00	Disagree	
1.00	Strongly Disagree	Disagree

Generation of Websites Quality metrics

A website quality metrics is defined by a measurement method and the measurement scale. In order to evaluate the number of measurable physical or abstract attributes for understanding and optimizing websites usage. Web metrics is like a visitor's journey once on the website. For example, the interface design characteristics will keep people on the website; accuracy of information characteristic will increase people's trust, and encourage people to seek information from the website. Website metrics assess a website in different domains which include e-commerce, academic, advertisement and so on. Each characteristic is compared against key performance indicators, and used to improve a website quality. In Websites Quality Metrics, Lilburn et al proposed a Quality Compliance Framework (QCF) consisting

of components such as quality measurement, quality characteristic, quality sub-characteristic and measurable indicator.

Quality Compliance Framework (QCF):

Quality measurement is the quality achievement in terms of a percentage value that indicates the degree of an overall quality compliance of the system while the Quality Characteristics are the high level quality factors of a web application. A quality characteristic may have many levels of quality sub-characteristics. Quality sub-characteristics are the lower level quality criteria that break down its parent characteristic to more measurable criteria.

• Quality indicators (criteria) are the measurable units of quality in QCF. A quality attribute may belong to one or many quality characteristics or quality sub-characteristics. QCF provides the quality measurement in a simple quality compliance scale. The scale starts from 0% and ends at 100%, where 0% indicates poor quality compliance and 100% indicates excellent quality compliance. This is the QCF score of the web application.

QCF works using bottom up approach. The metric for an attribute is converted to a 0% to 100% scale. Then the higher- level QCF score is calculated based on the QCF scores earned by the lower level children attributes, sub-characteristics, or indicators. Final score is the quality measurement. The following formulas show how the quality measurement is calculated for different components of QCF:

Quality measurement

Quality Measurement = Children QCF/ No. of children.

Characteristics and sub-characteristics QCF score

Quality Characteristic Score = Children's QCF/ No. Of children

• **Attribute QCF score**

Quality indicator = (Earned Score/ Possible Score) Here "Children" refers to the quality characteristics, quality sub- characteristics, or quality indicators in the

hierarchy. It is worth remembering that the relative importance of some features changes depending on the specific purpose of the website, and also on the purpose of the page. Therefore, all the resulting values must be weighted.

The high level quality characteristics and their low level sub quality characteristics as well as their attached desire weights obtained from the data analysis carried in this study is represented in the table below as follows:

HIGH-LEVEL CHARACTERISTIC	LOW-LEVEL SUB CHARACTERISTICS	LEVEL SCORE	TOTAL LEVEL SCORE	QUALITY INDEX
Usability	Understandability	4		
	Multiple Language Support	3		
	Interactivity	4		
	Straightforwardness	4		
	Learnability	4		
	Operability	3	22	0.24
Functionality	Search and retrieval	3		
	Navigation	4		0.12
	Interoperability:	4	11	
Content	Currency of information	3		
	Accuracy of information	3		
	Authority of information	3		
	Relevance of information	4		
			13	
				0.14
Efficiency	Loadability	4		
	Feed back	3		
	Accessibility	3	10	
				0.11
Reliability	Recoverability	3		
	Fault tolerance	3		
	Information consistency	4		
	Availability	3	13	0.14
Interface Design	Aesthetics	4		
	No page overcrowding	3		
	Consistent page alignment	3	14	0.15
	Similar fonts and colors	4		
Security	Policies	3		
	Protection against hacking	4	7	0.08
TOTALS			90	1.00

TABLE 5:1 EVALUATION WEIGHTS TABLE

Theoretically, the quality index of an academic website (Denoted by QI) can be calculated by adding up values from measuring the high level quality characteristics

using appropriate weights (as indicated in the table above). Therefore theoretically the Quality index of an academic website can be calculated using the relationship:

QI= *Usability + Functionality + Content + Efficiency + Reliability + Interface Design + Security*

The sub characteristics evaluation weights for the model should be adjusted to a common scale in order to facilitate comparisons of the various factors in the model (Hristov et al 2012). Hristov et al asserts that the normalization of these values to the range of (0 to 1) is common in software metrics. The beta values also formed an input in the calculation of total quality index. The Beta value is a measure of how strongly each independent variable influences the dependent variable. The beta is measured in units of standard deviation. The Beta value is used to assess the strength of the relationship between each independent variable to the dependent variable and the higher the beta value the greater the impact of the independent variable on the dependent variable. The table containing Beta values obtained from regression analysis from the data collected one the factors and how each impact on the quality of an academic website are as shown below:

Parametric Estimates	
Parameter	Beta
(Constant)	0.714*
Usability	0.214*
Functionality	0.36*
Content	0.299*
Efficiency	0.184*
Reliability	0.311*
Interface Design	0.326*
Security	0.517*

* Significant at the 0.05 level

The overall academic website quality index was given by the model formula:

$$Quality\ Index = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 \dots\dots\dots\dots$$
(3)

Where: β_0=constant, $\beta_1 \dots \dots \beta_7$ = parameter estimates, X_1 = Usability Weight, X_2 = Functionality Weight, X_3 = Content Weight, X_4 = Efficiency Weight, X5 = Reliability Weight, X_6 = Interface Design Weight and X_7 = Security Weight

On substituting the values we have:

Total Quality Index= $0.714 + 0.214X_1 + 0.36X_2 + 0.299X_3 + 0.184X_4 + 0.311X_5 + 0.326X_6 + 0.517X_7$

Where X_1 = Usability, X_2 = Functionality, X_3 = Content, X_4 = Efficiency, X_5 = Reliability, X_6 = Interface Design, X_7 = Security and Total Quality index is the overall website quality.

Where it was found from the quality evaluation table (Table 5.1) that X_1 = 0.24, X_2 = 0.12, X_3 = 0.16 , X_4 = 0.11, X_5 = 0.14, X_6 = 0.15, X_7 = 0.08. Total Quality Index =0.9881, which is approximately 0.99 or 1.00. This are subdivided into three categories of quality i.e. Poor Quality, Average quality and Excellent quality. The quality weights determine the quality levels of an academic website. According to Priyandri (2009) the weights attached to likert scale varies. Imran (2013) describes that classification and interpretation of weights obtained from likert scales varies according to domains and requirements. He stated that if the value is 0.7 or higher, it will be considered as 'High level of awareness', if the value is 0.4 to 0.69, then it will be interpreted as "Medium Level of Awareness", if the value is 0.39 or lower then it will be interpreted as "Low Level of awareness". However the following were adapted for this research work based on the academic website domains.

Table5:25 Interpretation of quality index

DESIRE WEIGHTS , Q	DEGREE OF QUALITY
0 QI<0.39	Poor

0.40 QI<0.69   **Average**

0.70 Q<1.00   **Excellent**

1.6 Implementation of the model Tool

The proposed model only comprises of structured lists of quality characteristics. After assigning weights to the high level quality characteristics and sub quality characteristics, it would be interesting to design and develop a software tool that make simpler the quality evaluation activity. This section discusses in detail how the adopted quality characteristics were used to design and implement the software tool for academic website quality evaluation model.

5.7 Academic website model Tool System

This section outlines the method used for the development of a system tool to easily implement the evaluation of quality in academic websites. It adopts the waterfall methodology for software application development. It explains the various phases involved in the development which includes feasibility study, requirements specification, system design, detailed design, programming, system testing & implementation and system operation & maintenance.

The waterfall method is a set of predefined steps followed in developing a system. It centers majorly on planned work during system development. The cycle shows how the stages are inter-related and how the whole cycle constantly involves referring back and going back to what has already been done to ensure a thorough system is actualized in the process.

5.7.1 Feasibility study

Feasibility is the study carried to find out whether it is possible to develop a system to solve the prevailing problem investigated. This is usually an initial study undertaken before any work on system development can commence.

5.7.2 Requirements specifications

This mini section contains a general description of the system to be designed. This acts as a general guide to the rest of the system design. It details what the system is

expected to do as well as the minimum requirements of the system to guide the researcher and avoid development of a complex system which might not be necessary.

Requirements specification encompasses designing of activities that would give the overall goals and more specific requirements for design of academic website quality evaluation tool. The main goal of the tool is to simplify quality evaluation of academic websites. The requirements specifications are further broken down into two categories:-

5.7.3 Functional requirements

I.   Cluster the ratings of the evaluator based on each characteristic broken down into several sub characteristics

II.   Give a brief detail of each sub characteristic to guide the evaluator

III.   Take the rating of the evaluator weights of each category sub characteristics as inputs and compute the average overall of the category characteristic

IV.   Take the average rating of each characteristic as inputs and compute the overall average quality of the academic site.

V.   Store the results of the evaluator in a database

VI.   Compute the final website quality from the evaluator weights and state the breakdown summary of each characteristic and its sub characteristic

5.7.4 Non-functional requirements

The following are the non-functional requirements of the system to be developed in this research work

I.   Simplify quality evaluation of academic websites

II.   Interface to evaluators should be simple

III.   Change of choices at will

IV.   Easy modification to add more characteristics

V.   Documentation of system design

VI.   Keeping the overall system "simple and stupid"

VII.   Few clicks to achieve evaluation

VIII.   The system should have adequate understandability and maintainability

5.8 System Design

In this step, the requirements are translated into a suitable system showing the use case diagrams, activity diagrams, database designs, selection constructs and sequence constructs.

5.8.1 Use case diagrams

The quality evaluation system is to be used by the evaluator in the evaluation process of an academic website. The evaluator will use the system in rating quality of each quality characteristics of an academic site based on the sub characteristic of each category quality, generate evaluation reports either through printing, viewing or even saving the reports.
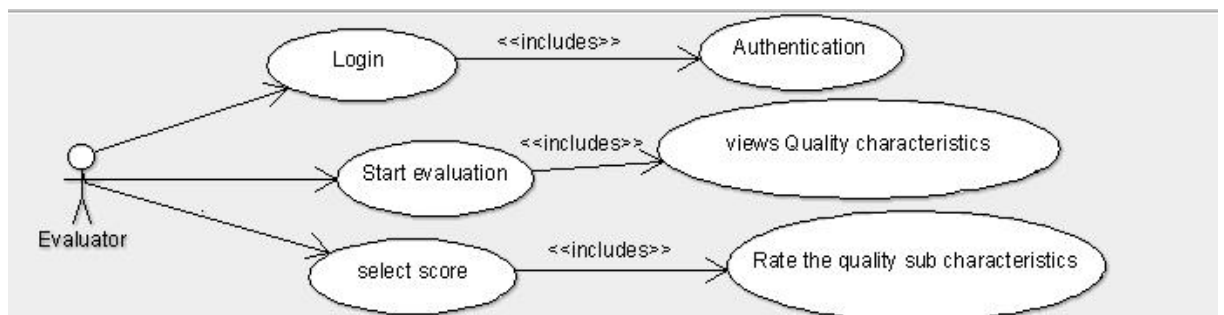
FIGURE 5: 3 USE CASE DIAGRAM

5.8.2 Classes

The objects used by the tool are outlined in figure 5.4 below. This depicts the visualization describing the different parts of the evaluation tool.
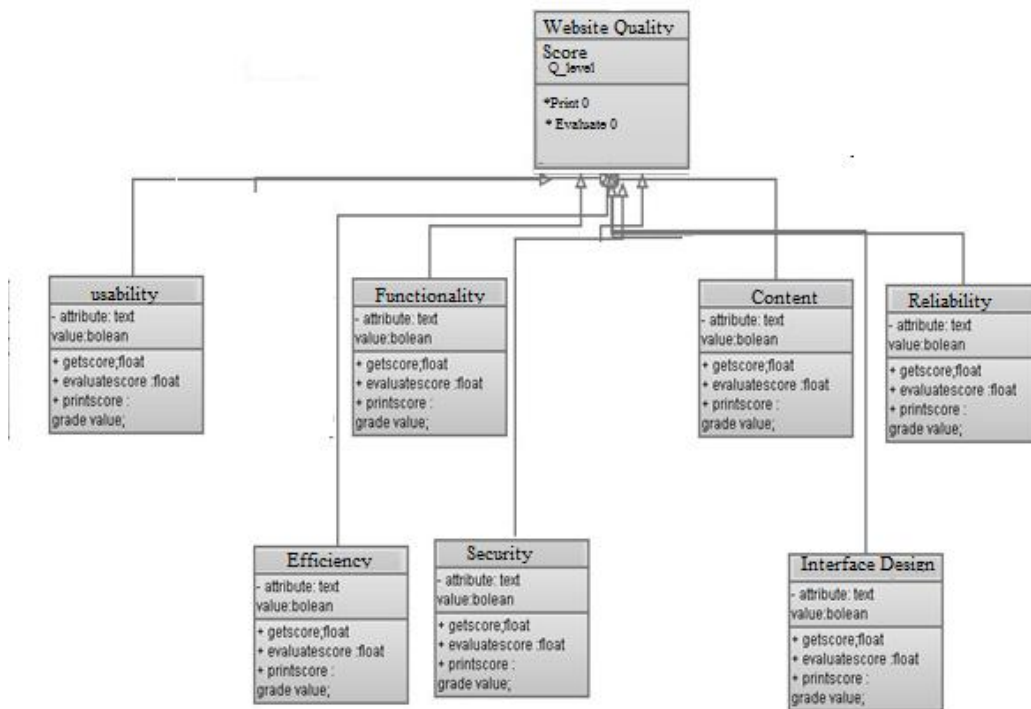
FIGURE 5: 4 CLASS DIAGRAM

5.8.3 System coding/ programming

System coding is the actual processes of converting a design model in to its equivalent program. This is done by creating a system using a particular programming language. The end result of this stage is a program which can be translated to machine language.

At this phase nine modules (Login, seven interfaces for each quality attribute and the overall report interface) were considered. Jsp, which was found more conversant to the researcher was used a programming language. The following are some of the snapshots of the interfaces of the tool designed to ease Evaluation work:-
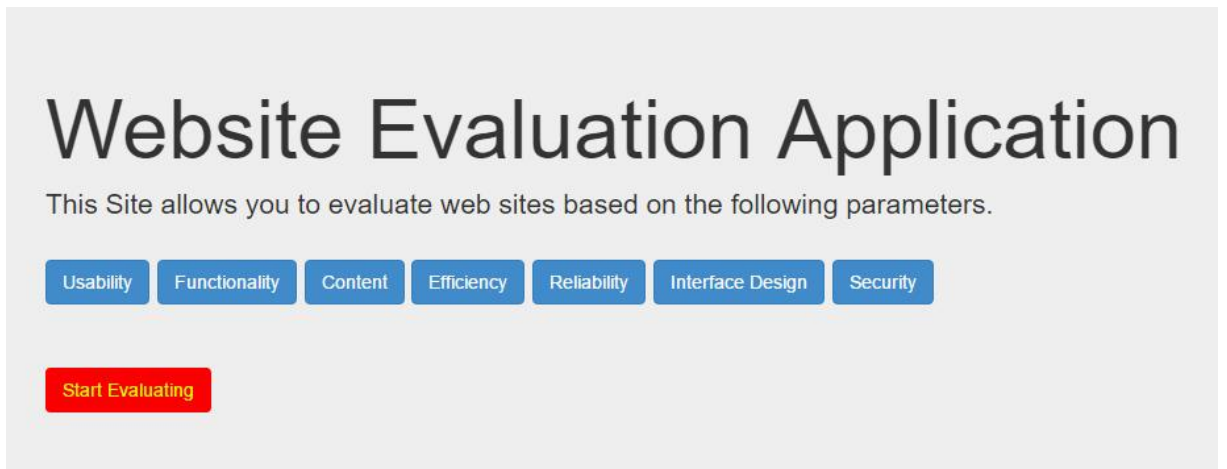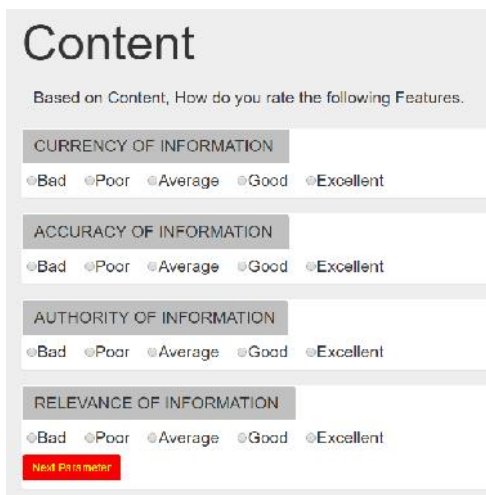
Content Interface

FIGURE 5: 6 CONTENT INTERFACE

Efficiency Interface

FIGURE 5: 7 EFFICIENCY INTERFACE

FIGURE 5: 8 INTERFACE DESIGN

Reliability Interface

90

FIGURE 5: 9 RELIABILITY INTERFACE

Security Interface

FIGURE 5: 10 SECURITY INTERFACE

Functionality Interface

FIGURE 5: 11 FUNCTIONALITY INTERFACE

Usability Interface

FIGURE 5: 12 USABILITY INTERFACE

Overall Results

Evaluation Results

Based on Your Evaluation, the following are the results.

CONTENT RESULTS

Currency of Information: 0.0

Accuracy of Information: 0.0

Authority of Information: 0.0

Relevance of Information: 0.0

Score: 0.0

USABILITY RESULTS

Understandability:0.0

Interactivity: 0.0

StraightForwardness: 0.0

Learnability: 0.0

Operability: 0.0

Multiple Language Support: 0.0

Score: 0.0

EFFICIENCY RESULTS

Loadability: 0.0

Feed Back: 0.0

Accessibility: 0.0

Score: 0.0

RELIABILITY RESULTS

Recoverability: 0.0

Fault Tolerance: 0.0

Information Consistency: 0.0

Availability: 0.0

Score: 0.0

FUNCTIONALITY RESULTS

Search and Retrieval: 0.0

Navigation: 0.0

Inter Operability: 0.0

Score: 0.0

INTERFACE DESIGN RESULTS

Aesthetics: 0.0

No Page Overcrowding: 0.0

Consistent Page Alignment: 0.0

Font and Color: 0.0

Score: 0.0

SECURITY RESULTS

Security Policy: 0.0

Protection against Hacking: 0.0

Score: 0.0

WEBSITE AGGREGATE RESULTS

Total Score: 0.0/26

Average Score:0.0

Remark.Aggregate Website Quality is Poor

FIGURE 5:23 OVERALL RESULTS INTERFACE

CHAPTER SIX

MODEL VALIDATION AND DISCUSSIONS

6.1. INTRODUCTION

In order to ascertain the effectiveness of the proposed model, a validation process was carried out using five operative academic sites. The chosen sites are typical and well known regionally as well as globally. The major aim of this validation process is to further understand and compare the current level of realization of a given set of requirements with regards to quality in academic websites and that the final tool developed after the research meets its intended goal.

6.2 Validation procedure.

In order to evaluate and compare and rank the quality of the sampled websites, the researcher applied the developed system tool to evaluate

Tsigereda framework was used as a baseline in the validation process. This procedure involved the aggregation of low level sub characteristics to yield the total value of the high level characteristics which further sum up to give an overall academic website quality in terms of a defined indicator. The results of the evaluation was discussed and conclusions made. To conduct the research the following academic websites were selected:-

Name of institution	URL
Jomo Kenyatta University of Agriculture and Technology	Www. Jkuat.ac.ke
Moi University	www.mu.ac.ke
University of Eldoret	www.uoeld.ac.ke

Table 6.1: Academic Websites Evaluated

Since academic websites evolve dynamically day in day out, the last online version of the sampled websites which began January 12th 2016 and ended on February 25th 2016 were evaluated. This evaluation work also focused mainly on the institutions websites as a whole rather than any individual faculty, school or campus.

6.3 Validation Results.

6.3.1 University of Eldoret Website

The university website (www.uoeld.ac.ke) was analyzed with the framework and the following results were obtained.

HIGH-LEVEL CHARACTERISTIC	LOW-LEVEL SUB CHARACTERISTICS	Score	Weighted Total Score	Weighted Average Score
Usability	Understandability	1		
	Multiple Language Support	0		
	Interactivity	2		
	Straightforwardness	1	07	0.32
	Learnability	2		
	Operability	1		
Functionality	Search and retrieval	2		
	Navigation	0	03	0.27
	Interoperability:	1		
Content	Currency of information	2		
	Accuracy of information	2		
			07	0.54
	Authority of information	0		
	Relevance of information	3		
Efficiency	Loadability	4		
	Feed back	0		
	Accessibility	0	04	
				0.40
Reliability	Recoverability	2		
	Fault tolerance	2		
	Information consistency	4	10	0.71
	Availability	2		0.21
Interface Design	Aesthetics	1		
	No page overcrowding	0		
	Consistent page alignment	1	3	
	Similar fonts and colors	1		
Security	Policies	1		
	Protection against hacking	0	1	0.14
TOTALS			34	0.38

Table 6.2: Evaluation Results of UOE Website

Results of Evaluation

The UOE website evaluated in this research work was accessed between 12th January 2016 and 25th February 2016. If there exist any other changes after 25th February 2016, then they have not been captured in this evaluation. From the evaluation it was noted that the total

weighted score for the seven high level characteristics was 34 divided by the maximum score total weighted score for the framework which is 90. The average quality weight of the website was found to be 0.38 which is categorized as Poor quality. The explanation of the results is as follows;

The usability of the site showed a poor quality level. Understandability of the website is way below average. This is due to the nature of how the homepage was designed with user conflicting menus. Several label terms used are also not understandable and thus hard for first time visitors to navigate their way around the website. Multiple language support is not supported and the overall straight forwardness of the site is quite wanting, thus making the overall operability of the website an uphill task.

The results for search and retrieval, navigation and interoperability sub characteristics of functionality showed poor quality. Most functionalities of the website do not have appropriate levels expected, this includes lack of clear and consistent navigation in all pages and the Go Back link in most pages do not work. The website opens in both mobile and other PDA devices but the main menus are not visible. Search by category such as Course ID, Department, faculty etc.

Other notable quality aspects include News and events for 2014 and 2015 still available under news section. Currency of information is fair though no display of dates nor authors of the information on the site. There is no feedback features for users. www.isithacked.com returned an incidence of hacking. The indication of "powered by Drupal" a free CMS also pose a security risk to the website. No presence of code 301 that redirects users from HTTP to HTTPS. In terms of recoverability, when the site was running and a sudden unplug of network cable, the website was able to continue receiving data from its initial point.

6.3.2 Jkuat Website

The Jkuat Website (www.jkuat.ac.ke) was evaluated using the website quality framework and the following results were obtained.

Table 6.3: Evaluation Results of JKUAT Website

HIGH-LEVEL CHARACTERISTIC	LOW-LEVEL SUB CHARACTERISTICS	Score	Weighted Total Score	Weighted Average Score
Usability	Understandability	1		
	Multiple Language Support	0		

Characteristic	Sub-characteristic	Score	Weighted Score	Quality Weight
	Interactivity	2		
	Straightforwardness	1	07	**0.32**
	Learnability	2		
	Operability	1		
Functionality	Search and retrieval	2		
	Navigation	0		
			03	**0.27**
	Interoperability:	1		
Content	Currency of information	2		
	Accuracy of information	2		
			07	**0.54**
	Authority of information	0		
	Relevance of information	3		
Efficiency	Loadability	4		
	Feed back	0		
	Accessibility	0	04	
				0.40
Reliability	Recoverability	2		
	Fault tolerance	2		
	Information consistency	4	10	**0.71**
	Availability	2		
Interface Design	Aesthetics	1		**0.21**
	No page overcrowding	0		
	Consistent page alignment	1	3	
	Similar fonts and colors	1		
Security	Policies	1		
	Protection against hacking	0	1	**0.14**
TOTALS			34	**0.38**

Results of Evaluation

From the evaluation it was noted that the total weighted score for the seven high level characteristics was 65 divided by the maximum score total weighted score for the framework which is 90. The average quality weight of the website was found to be 0.71 which is categorized as Good quality. The explanation of the results is as follows;

The results of usability characteristic showed that the website usability is of good quality. However, the website do not support multiple languages thus cannot support users from various diverse international countries. Learnability and straight forwardness sub characteristics indicated good quality.

Search buttons are available in all pages of the website. However the website lacks search using various categories such as by school, faculty, school, Course ID etc. The website is also

viewable in various browsers and devices, however the pages of the website do not auto-fit the various different screen sizes.

The quality level of the accuracy and relevance of information in the Jkuat website has an excellent quality. Most pages lacked authors of information and references; however university distinctiveness is present in all pages through availability of Logo, Slogan and copyright. Feedback is always available in most pages with evidence of reply from the various from the concerned departments. Feedback for users has also been enhanced through availability of Ombudsman office link as well as a compliments and complaints section. The researcher could not ascertain how quick the responses were made.

Aesthetics scored the highest score of 0.93 which translates to Excellent Quality. In terms of broken links, the link to school of Business under academics, schools and faculties is broken. The link to PAU on the main page should open in a new tab rather than opening on the current tab. This few mentioned factors should be improved to increase quality.

6.3.3 Moi University Website

The Moi University Website (www.mu.ac.ke) was evaluated using the website quality framework and the following results were obtained.

Table 6.3: Evaluation Results of Moi University Website

HIGH-LEVEL CHARACTERISTIC	LOW-LEVEL SUB CHARACTERISTICS	Score	Weighted Total Score	Weighted Average Score
Usability	Understandability	4	18	**0.82**
	Multiple Language Support	0		
	Interactivity	3		
	Straightforwardness	4		
	Learnability	4		
	Operability	3		
Functionality	Search and retrieval	2	8	**0.73**
	Navigation	4		
	Interoperability:	2		
Content	Currency of information	2	7	**0.54**
	Accuracy of information	3		
	Authority of information	1		
	Relevance of information	2		
Efficiency	Loadability	2	4	**0.40**
	Feed back	2		
	Accessibility	0		

Reliability	Recoverability	2	11	**0.85**
	Fault tolerance	2		
	Information consistency	4		
	Availability	3		
Interface Design	Aesthetics	4	11	**0.79**
	No page overcrowding	3		
	Consistent page alignment	2		
	Similar fonts and colors	4		
Security	policies	0	2	**0.29**
	Protection against hacking	2		
TOTALS			61	**0.63**

Results of Evaluation

From the evaluation it was noted that the total weighted score for the seven high level characteristics was 61 divided by the maximum score total weighted score for the framework which is 90. The average quality weight of the website was found to be 0.63 which is categorized as Good quality. The explanation of the results is as follows;

The understandability of Moi university website indicated an excellent quality. This indicates that the users can easily understand the overall structure and website elements including understandable terminologies used. The website do not support multiple languages, this means that any user who do not understand the English language will be limited to use the website. The website has moderate interactivity. Straightforwardness and learnability are good.

The results for search and retrieval, navigation and interoperability sub characteristics of functionality showed good quality. The website indicated that the website has good navigation followed by interoperability and search quality sub characteristics. Moreover the result of interoperability showed that most functionalities of the website do not work in different screen settings.

Although the content characteristic scored moderate quality, some improvements need to be made. This includes availing authors of the pages as well as the dates the contents were updated/created. The results of Loadability indicated a moderate quality level. This means that the website takes a long time to load as compared to the other websites evaluated. Most pages in the website takes you to a page without content. This indicates that most departments have not provided their content or whatsoever.

The interface of the website is pleasant and the alignment of text is constant throughout the website. Similar fonts and colors have also been used. There are also no policies regarding

use of information. Generally few things needs improvement and the website will turn out to excellent.

6.4 Evaluation using the base Model

In order to ascertain or give a more accurate evaluation procedure, a rating from previous similar work was used. The evaluating method of the Tsigereda framework uses Likert questions to evaluate the quality of academic websites from user perspective. The base Model was distributed to users of the selected websites which are majorly students, Teaching staff and non-teaching staff. The base model uses five high level quality factors to determine quality:-

1. Content
2. Usability
3. Reliability
4. Efficiency
5. Functionality

In this evaluation method the questions in likert scale format are used which ask users to show their level of agreement according to the questions asked by each high level quality factor. The quality value of the responses is evaluated based on the following responses.

Response options	Assigned Merit value
Strongly Agree	4.00
Agree	3.00
Neutral	2.00
Strongly Disagree	1.00

The quality merit point of the academic website is obtained by adding the total merits for all the total merit points for all the questions and dividing by the total number of questions asked. The results from the base model will be used to compare with the results of the proposed academic website quality framework. This will assist to test how effective the

proposed framework. The following are the results obtained from sampled users of the selected websites

Table 6.2: Evaluation Results of using the base model

.No.	High Level Quality Factors	Merit Values & Quality Levels					
		UOELD	Quality Level	JKUAT	Quality Level	MOI	**Quality Level**
1	Content	0.61	Good	0.79	Good	0.52	**Average**
2	Usability	0.38	Poor	0.63	Good	0.87	**Good**
3	Reliability	0.78	Good	0.80	Excellent	0.81	**Excellent**
4	Efficiency	0.50	Average	0.58	Average	0.47	**Average**
5	Functionality	0.33	Poor	0.69	Good	0.67	**Good**

6.5 Comparisons of the base model and the developed framework in the validation process

The major reason of using the base model is to compare the effectiveness of the developed academic website quality evaluation framework by analyzing the responses of the selected users of the academic website and the researchers rating using the new proposed framework.

By comparing the results of the two evaluations it is discovered that both results differ by only small margins. Nevertheless the new framework has been viewed in seven different high level characteristics in order to add more quality attributes, that is, Interface Design and Security which were found to be of criticality in the evaluation of the academic website quality.

The base models also do not assign weights but uses likert format and thus do not consider the different desire weights attached to each quality sub characteristics. The new framework considers desire weights with each quality characteristic having been assigned desire weights in order to ascertain quality of academic websites. The base model also considers mainly evaluation of academic websites on user's point of view. However quality evaluation of an

academic website cannot be a one-time work, the evaluation result in this research work shows that the developed framework is more effective than the base model since it can be used in both evaluation and as a guide in designing an effective academic website.

CHAPTER SEVEN

SUMMARY, CONCLUSIONS AND FUTURE WORK

7.1 SUMMARY

Two groups i.e. Web developers and institutional Webmasters (regarded as key respondents in this study) were served with questionnaires. They are in charge of academic website projects developments as well as administration and therefore conversant with the quality characteristics and sub characteristics prioritized in the development of academic websites. The model was designed based on the following phases:-

(i) Thorough Gathering of Quality characteristics dimensions from widely accepted models or models of website and software quality was done and quality dimensions discussed by different authors in different contexts of web like usability of websites, quality in web portals, and web applications, etc. were also greatly considered.

(ii) Data was then collected on Quality characteristics factors from web developers and web masters of academic institutions to observe their expectations of quality in academic sites context by means of a questionnaire and thus measuring their desires as weights

(iii) Merge the quality dimensions from phase 1 and 2 and select the appropriate quality dimensions required to assess data quality in academic websites by relating developer expectations on quality while assigning each characteristic and sub characteristic a desire weight.

(iv) From the result of phase 3 design the model evaluation criteria and validate the model with five Kenyan academic institutions.

(v) Evaluate the model with the base model to show how far the new model is valuable compared to the base model.

(vi) Develop a tool to ease academic website evaluation.

The model first outlines necessary high quality characteristics, which are further classified into sub characteristics. Common quality characteristics obtained from the research done make up the high level quality characteristics and sub characteristics. The sub-quality characteristics identified are important features of the academic websites quality assessment. Each Sub characteristic of the High level attribute has also been assigned desire weights.

7.2 CONCLUSIONS

It is important to have a tool that guides web developers and administrators in the development of quality academic websites. This will help to improve the services offered to

the users of such sites as well as assist boost the image of such institutions globally. The proposed model if implemented will assist academic institutions in all aspects of providing quality websites to its stakeholders. The web developers should consider the seven high level characteristics in order to design websites that are of good quality thus make them competitive in the current competitive industry.

The new model will be able to assist institutions to reduce on uncertainties of determining whether their sites meet the user's demands and criteria. The model also brings in the considerations of security in an academic website. This will ensure that the websites developed are secure and thus do not get hacked and thus reduce chances of loosing important information hosted in the website.

The proposed model is a unique work developed in Kenya and therefore it should be adopted in order to help in improving quality of academic websites. The model is also generic and thus can be used in any country anywhere in the world.

The adoption of desire weights in this research work may vary from one evaluator to another and this model may allow for changes to suit various scenarios in the evaluation of quality of academic websites. This may include conversion of desire weights in percentages form or whatsoever.

7.3 Recommendations

From this research work, it can be noted that evaluating the quality of an academic website is not a one task. However, quality evaluation of an academic website is very important since it assist the institution to know whether their sites meet the user satisfaction as well as the required level of quality. This means that successful web quality evaluation requires involvement of all stakeholders of an institution. The following are some of the recommendations to different stakeholders of an academic websites:

7.3.1 Recommendations for Academic institutions

A website portrays the image of an academic institution. It acts a gateway of any information regarding the institution to the whole world. Academic websites have remained popular for sharing information and for communication. The institutions need to realize maximum user satisfaction due to the several issues of poor quality. Several metrics may affect indirectly on the popularity of an institution and thus it's necessary to evaluate a website so that it can satisfy all the stakeholders. In light of this, academic institutions should:

- Have a rigorous calendar of determining quality of their websites so as to establish whether quality is continuously maintained.
- Continuously encourage their web masters and the entire staff involved in embracing different quality aspects of their websites as proposed in this model.
- Nature the culture of websites quality by offering training to their webmasters and all those involved in keeping the website in place.

7.3.2 Recommendations for Website administrators

The researcher recommends the following to the web developers in relation to developing quality academic websites:

- Adopt this proposed model that has been formulated in this study, this will help in developing quality academic websites.
- Adopt any other websites good design practices that might not have been captured by the proposed model. This includes aspects such as having applications such as Library website embedded in the site, admissions, booking of hostels online and so forth.
- Continually attend trainings regularly in order to assist in learning new aspects in website quality aspects.

7.3.3. Recommendations for Further Research Work

This research work presented a quality evaluation model for evaluating quality in academic websites that considers seven high level quality characteristics: Usability, Functionality, Reliability, Efficiency, Content, interface design and Security – coupled with sub characteristics as the main determinants of quality in each high level Quality characteristics. The recommendations on how to improve this research work are given as follows:
- The proposed model in this work should be subjected to several rigorous validations in order to determine its effectiveness. The result should form a basis for improvement.
- A research should be carried out to determine the hierarchy in which the characteristics can be arranged in a reasonable way.
- The tool implemented in this research work is only meant to make the evaluation work easy and too more of manual. It would be interesting to design and develop an automatic tool which can evaluate a website with the input of a URL and give the various dimensions of quality.

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Appendix I: Questionnaire

James Kosgey

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Dear Respondent,

Re: Request To Participate in MSc Research Questionnaire

I am a student at Jomo Kenyatta University of Agriculture and Technology (JKUAT) pursuing a Master of Science in Computer systems. As a requirement for my degree program; I am conducting a study on a framework suitable for academic websites, which will culminate in the development of a framework for determining quality in academic websites, based on adopted quality factor weights.

The questionnaire is designed to collect data on the adopted website quality characteristics. Please take a few minutes to answer the questions below. Kindly respond to all the items in the questionnaire. Your response will be strictly confidential and anonymity will be ensured. Put a tick (✓) alongside the option that is applicable to you or fill in the spaces provided. DO NOT indicate your name on this questionnaire. The data will be processed objectively, so answer the questions truthfully.

Thank you for your time and cooperation

PART ONE: BASIC DATA

1. Gender   Male ☐   Female ☐
2. What is your status?

   ☐ Web developer ☐ Web Master

3. How many Years have you been in web Development

a) Below 1 year ☐

b) 1-3 years   ☐

c) 3-5 years   ☐

d) 5 and Above ☐

4. What is your educational level?

☐ **Certificate**   ☐ **Diploma and Above**   ☐**Bachelors**

☐ **Masters**   ☐**PHD**

PART TWO: WEBSITE QUALITY

Kindly rate the following attributes of a website in terms of website quality. Put a tick (✓) alongside the option that is applicable to you in the spaces provided.

Rate the statement using the 1- 5 point Likert scale provided where (5 = strongly agree, 4=agree, 3=neutral, 2=disagree, 1=strongly disagree).

6. Usability of the website

Statements	5	4	3	2	1
Academic Websites developed ensures easiness of users to find way to information from the homepage?					
Sites developed ensure users accurately predict which section of the website contains the information that he/she is looking for?					
The homepage content of the websites developed makes a user want to explore the site further?					
Is the website you develop well suited for first time visitors?					
How do you rate the overall structure of the websites you develop? Are they straight forward?					

In what other ways do you ensure usability of academic websites?

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Has good usability of academic websites directly contributed to quality of academic websites?

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………………………………………………………………………………………………

7. Functionality of the Website

Statements	5	4	3	2	1

	5	4	3	2	1
Do the websites developed contain administration tools which enhance efficiency? i.e. Help, FAQ					
How do you rate all functionalities? Are they clearly labeled?					
Do the Academic websites developed ensure that it is easy to navigate the website? I.e. options to return to home page, top of pages are provided.					
Do you make linkages to other sites that have discussions on similar topics?					
The selected graphics in the websites developed serve a functional purpose					

What other functionality attributes do you consider when developing academic websites?

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…………………………………………………………………………………………………

Has functionality influenced the quality of academic websites? Yes/No (explain your answer)

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…………………………………………………………………………………………………

8. Efficiency of the website

Statements	5	4	3	2	1
How do you rate the switch time between pages? Is it in real time?					
The information posted on the website is always timely?					
How do you rate recoverability rate of your systems in the event of system failure or hacking?					
The web services and functionalities of the sites developed are perfect					
The websites developed offers feedback features for visitors					

What else do you do to consider ensuring efficiency of academic websites?

…………………………………………………………………………………………………

…………………………………………………………………………………………………

9. Reliability of the website

Statements	5	4	3	2	1
The information on the academic websites are always consistent					
The forms on the website are working					
The academic websites may contains some broken links					
Information on the website is regularly updated.					
There are communication tools when the website is down.					

In what other ways do you consider academic websites become reliable?

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………………………………………………………………………………

Does reliability influence the quality of academic websites? Yes/No. (Explain your answer)

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…………………………………………………………………………………………………

10. Interface design

Statements	5	4	3	2	1
The interface of the website developed is pleasant					
We ensure that No pages are crowded with information					
Similar fonts and colors are used throughout the developed site					
Alignment of text and page elements are constant throughout the website					

Is there any other interface attractiveness techniques you use?

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…………………………………………………………………………………………………

11. Security of the website

Statements	5	4	3	2	1
We ensure that the users are aware of the security policies regarding information protection in the institutional website					
The website developed is well protected.					
The academic website developed is protected from malicious					

attacks and hacking					
The academic website protects unauthorized modification to information.					
The academic website developed is secure so as to avoid loss of information					

In what other ways do you ensure security of academic websites?

………………………………………………………………………………………………

………………………………………………………………………………………………

12. Content

Statements	5	4	3	2	1
The content on the website is regularly updated					
The information provided in the website is clear (not ambiguous)					
I think the website provides important information to students					
It is easy to find information about upcoming events in the academic websites					
Author names of pages are available					

In what other ways do you ensure content quality of academic sites?

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………………………………………………………………………………………………

Does content quality influence the quality of academic websites? Yes/No. (Explain your answer)

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…………………………………………………………………………………

11.What weight would you assign to each of these attributes given the range of 1-5 where 5 is the most important and 1 the least important

Statements	5	4	3	2	1
Usability					
Functionality					
Reliability					
Efficiency					
Security					

Interface design					
Content Quality					

12. In your own opinions what improvements would you want to see on institutional websites?

_____
_____
_____
_____

_____
_____

12. In your opinion is there any other attribute (parameters) that you think should be considered in evaluating institutions website?

_____
_____
_____
_____

Thanks and God bless.